ALBERTA ENVIRONMENT
LAND MONITORING PROGRAM INVENTORY AND NEEDS ANALYSIS

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Matrix Solutions Inc.
ENVIRONMENTAL CONSULTANTS

ALBERTA ENVIRONMENT
LAND MONITORING PROGRAM INVENTORY AND NEEDS ANALYSIS

Report Prepared for:

ALBERTA ENVIRONMENT

Prepared by:

MATRIX SOLUTIONS INC.

(Original signed by)

Elizabeth McNaughtan, P.Ag., MBA
Project Consultant

(Original signed by)

Reviewed by
Pat Reid, P.Ag.
Principal Agrologist

(Original signed by)

Reviewed by
Leo W. Bouckhout, M.Sc., P.Biol.
Vice President, International

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Any comments, questions, or suggestion regarding the content of this document may be directed to:

Environmental Monitoring and Evaluation Branch
Alberta Environment
12th Floor, Oxbridge Place
9820-106 Street
Edmonton, Alberta T5K 2J6
Phone: (780) 427-6278
Fax: (780) 422-6712

Additional copies of this document may be obtained by contacting:

Information Centre
Alberta Environment
Main Floor, Oxbridge Place
9820-106 Street
Edmonton, Alberta T5K 2J6
Phone: (780) 427-2700
Fax: (780) 422-4086
Email: env.infocent@gov.ab.ca

EXECUTIVE SUMMARY

Alberta Environment (AENV) has determined that monitoring programs must support place based systems approaches including partnership delivery, continuous improvement and cross-ministry initiatives. In 2004, AENV created the Monitoring Management Team (MMT) to oversee the process. Six technical teams were initiated under the MMT, one of which was the Land Monitoring Team (LMT). The LMT team has identified three outcomes that future initiatives must support:

- Land monitoring programs assure that AENV is able to measure performance in achieving defined outcomes for environmental management.
- Land monitoring programs assure that AENV's regulatory responsibilities are met.
- Land monitoring provides accurate and timely information to support Sustainable Resource and Environmental Management (SREM); our partners' decision-making is guided by quality land monitoring information.

To support these and other potential outcomes the LMT identified the need to review current land monitoring programs and develop a needs analysis for future direction. Project scope excluded the waste management programs and strategy, which are being investigated under a separate project. Matrix Solutions Inc. was chosen to carry out this Land Monitoring Review Project. It included interviews with AENV staff primarily, workshops with AENV staff and other stakeholders, and an on-line survey.

NEEDS FOR LAND MONITORING AT ALBERTA ENVIRONMENT

Integral factors to ensure the effectiveness of land monitoring and land management were identified during the project and are summarized below:

1. **Knowledge and Information** - Information is the single greatest identified need and includes:

    - Knowledge of the baseline condition of the land.

- Knowledge of the effect from different land uses and pressures on land condition and sensitivity of land to impact.
- Development of place-based environmental outcomes and monitoring of indicators that can identify changes in the condition of the land.

2. **Outcome-Based Land Monitoring** - Few environmental outcomes and indicators have been developed with relation to the new land initiatives. These measurements need to be developed early in partnerships. Outcomes for AENV land monitoring must align with water and air monitoring outcomes to support Water Planning and Advisory Councils (WPACs) and the Land Use Framework for Alberta (LUFA).

3. **Leadership** - Leadership or champion's role for land within AENV is needed to ensure that the land monitoring needs of regulatory monitoring groups, watershed groups, other strategic initiatives and LUFA can be met.

4. **Development of Processes to Facilitate Cross-Ministry & Partnership Initiatives** - A strong need for process development to support future monitoring programs has been identified. Processes to work across ministries, develop partnership related products, and evaluate differently derived data sets are required. These processes must support AENV's desired role as systems coordinator for land monitoring and management issues.

5. **Definition of Data Requirements** - Data currently collected should be evaluated to determine suitability for the monitoring of outcomes and indicators in regulatory and other monitoring programs, and for cumulative and predictive modelling. Data gaps should be identified and monitoring designed to provide data. Evaluation of reporting needs should focus on electronic reporting and the use of distributed databases. Coordination of existing databases is needed, ideally through a portal approach such as the current pilot for watershed data sources. Stakeholders also identified a similar need for data sets held by other government agencies, industry and other partners. This portal approach would not require AENV to store or collect all of the actual data sets.

6. **Tools to Evaluate and Inform Management and Policy Decisions** - Predictive modelling informs management decisions and helps to evaluate the effectiveness of policy and

behaviour change. Data needs and data sets for predictive models have not been fully inventoried.

7. **Management Framework to Support State of Environment Reporting** - The provincial State of the Environment (SOE) reporting initiative should be derived from a management framework. This framework will gather information about the pressures on, condition of, and stewardship of land. To be an effective information source, SOE reporting for chosen indicators needs to be strongly supported by all government departments and partnerships.

8. **Base Long-Term Monitoring Programs** - Regulatory monitoring programs remain a key initiative for AENV land monitoring. These programs need long term monitoring programs to determine if policy, guidelines, standards and legislation are driving the desired behaviour in environmental management.

9. **Continued Research with Focus on Knowledge Products** - This need was identified for a number of areas such as post reclamation monitoring, effect on land quality from various land uses, and indicators to represent complex landscape management. The output of this research should be focused on knowledge products including the development and improvement of best practices, standards, criteria and guidelines for land management programs.

RECOMMENDATIONS

The first three recommendations for future action by the land monitoring team and AENV are the priority recommendations that will allow the LMT to take action on opportunities immediately.

1. **Direction for New Monitoring Programs** - Design of new monitoring projects should focus on land quality, riparian zone assessment, landscape parameters that describe effects of land use, and reclamation success monitoring. Seek broad partnership opportunities in defining and developing these monitoring programs.

2. **Assessment and Evaluation of Data** - Evaluation of data needs for regulatory and other monitoring programs, and for predictive and cumulative modelling. Also evaluation of electronic reporting design, the use of distributed databases and a portal access approach.

3. **Development of Processes to Facilitate Land Monitoring Team Programs** - Key processes include:

   - Integration of Cross-Jurisdictional Outcomes, Indicators and Programs - Develop a process to integrate outcomes, indicators and monitoring programs within partnerships and across the matrices of water, land and air will maximize the opportunities in land monitoring programs.
   - Partnership Protocol - Develop a protocol for working in partnerships as an empowered team contributing to cross ministry initiatives. For example, the partnerships envisioned by the development of WPACs. Watershed planning with respect to land is very new, and will require monitoring programs for riparian and upland landscapes.
   - Management Framework to Support State of Environment Reporting - Enhanced SOE reports would derive from a cross ministry management framework that identifies outcomes, indicators, performance measures and related monitoring.
   - Evaluation and Monitoring – A monitoring and assessment process will determine if policy, guidelines, standards and legislation are delivering environmental management behavioural change through regulatory programs.

4. **Modelling** - Evaluate the needs of cumulative effects and predictive modelling and whether data already collected meets those needs and how future data must be collected to be useful.

5. **Knowledge Products** - Focus on creating and strengthening the land related knowledge products developed within AENV.

6. **Partnership Initiatives** - Pursue partnerships to deliver scientific knowledge related to condition, pressure, stewardship of land, and equivalent land capability.

7. **Effective Public Engagement and Awareness** - Focus on communication efforts to ensure that the public is aware of environmental performance, and potential partners are aware of AENV land related efforts.

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1.0 INTRODUCTION

The Land Monitoring Review Project was initiated by Alberta Environment (AENV) in the fall of 2005 to provide an inventory of current AENV programs and a needs assessment for future land monitoring initiatives in the department. The project was carried out by Matrix Solutions Inc. (Matrix) between December 2005 and March 2006.

1.1 Background

In 2004, AENV decided to restructure its monitoring programs and created the Monitoring Management Team (MMT) to oversee the process. Six technical teams were initiated under the MMT, one of which was the Land Monitoring Team (LMT), charged with review of their programs. Initially, the MMT identified strong roles for water and air monitoring, but no concrete role for land monitoring under AENV's mandate. The LMT was formed in 2004 with representatives of all AENV business areas that deal with land issues. The Team recognized that AENV was moving from a limited scope of business to a broader approach to environmental management, embodied in areas such as watershed management, and that the role of current and future land monitoring programs within this broad approach required definition. The LMT identified the need to review current land monitoring programs and develop a needs analysis for future direction. The terms of reference for the Land Monitoring Review Project and the Request for Proposal were developed. Matrix was chosen to carry out the work.

In January 2006, a cross-ministry Monitoring Management Team was initiated, with members from AENV, Alberta Agriculture, Foods and Rural Development (AAFRD), Alberta Health and Wellness (AHW), the Energy and Utilities Board (EUB), Sustainable Resource Development (SRD), and Alberta Geological Survey (AGS). The AENV land monitoring review work will be useful to a cross-ministry review.

1.2 Scope of the Project

The review of land monitoring programs included those current and historical programs under AENV management, but did not extend to land monitoring programs in all government

departments. A cross-ministry evaluation may be initiated in the future. The scope specifically excludes the waste management programs and strategy, which are being investigated under a separate project. Land monitoring programs were identified broadly to include both ambient monitoring conducted by AENV and administrative programs that gathered the data from programs implemented by industry to meet regulatory requirements.

The information gathering stage included interviews, a survey and workshops primarily with employees of AENV, to elicit opinion and generate the land monitoring program inventory. The aim was also to canvas opinion on the future needs and focus of land monitoring within AENV.

The project deliverables and timeline agreed between the Project Team were as follows:

1. A detailed work plan and an example of the inventory framework, to be delivered December 16, 2005.

2. Interviews scheduled by December 23, 2005.

3. Interviews completed before January 27, 2006.

4. The workshops conducted in the week of February 6 – 10, 2006.

5. An interim report submitted by February 24, 2006, consisting of:

    - a detailed inventory of the monitoring programs within AENV's mandate;
    - a table of land monitoring outcomes developed through these programs; and
    - identification of linkages to AENV's business plan and other strategies (e.g. Sustainable Resource and Environmental Management Framework (SREM)).

6. A draft report submitted by March 15, 2006, and issued as final by March 31, 2006, which includes:

    - identification of duplications, gaps and partnership opportunities in land monitoring programs;

- recommendations for the future of land information needs and management based on current AENV outcomes and strategies; and
- identification of barriers to optimizing land monitoring programs, including system gaps, information-sharing challenges, and impediments to collaborative partnerships.

The inclusion of the on-line survey was agreed to by Matrix and AENV after the project was initiated.

1.3 Definitions and Acronyms

Several concepts and terms are used throughout this report for which the definitions as used are included below.

Monitoring – A system to supply information about an indicator to evaluate a desired outcome.

Partnership – A relationship between individuals of groups characterized by mutual cooperation and responsibility, for the achievement of a specified goal (The American Heritage® Dictionary of the English Language, Fourth Edition, 2000).

Place based – An identifiable area, such as a watershed, in which planning, use and monitoring can be focused.

Outcome – Outcomes are the results (both expected and unexpected) of either planned or unplanned actions or activities. For planning purposes, "outcomes" are the desired endpoints that guide the development and management (Lalonde, 2005).

Watershed – the area of land that catches precipitation and drains it into a larger body of water such as a marsh, stream, river or lake (Lalonde, et al., 2005).

Riparian zone – the land adjacent to a water body where water, soil and vegetation interact (Lalonde, et al., 2005).

A list of acronyms used in this report include:

Acronym	Full Name	Acronym	Full Name
AENV	Alberta Environment	SRD	Sustainable Resource Development
AAFRD	Agriculture, Agri-Food and Rural Development	EUB	Energy and Utilities Board
NRCB	Natural Resources Conservation Board	CFO	Confined Feeding Operation
SREM	Sustainable Resource and Environmental Management	LMT	Land Monitoring Team
WPAC	Watershed Planning and Advisory Council	SASS	Southern Alberta Sustainability Strategy
MOSS	Mineable Oil Sands Strategy	SAGD	Steam Assisted Gravity Drainage
EIA	Environmental Impact Assessment	SEA	Strategic Environmental Assessment
SA	Sustainability Assessment	CBM	Coal Bed Methane
PWAC	Provincial Water Advisory Council	SOE	State of the Environment
AAMDC	Alberta Association of Municipal Districts and Counties	AUMA	Alberta Urban Municipalities Association
ARMAA	Alberta Rural Municipal Administrators Association	GIS	Geographical Information System

2.0 METHODOLOGY

2.1 Interviews

In December 2005, the land monitoring programs to be included in the project were identified by AENV and discussed with Matrix. A primary contact for each program and, where possible, several alternates were identified (primary contact listed first, Appendix A). The initial request for an interview was sent to the primary contact for each program. It was agreed with AENV that Matrix would contact some of the alternate interviewees if the primary contact was unavailable during the entire project interview timeframe. Not all of the people identified as potential interviewees in Appendix A were interviewed. Several of the primary contacts had significant input or history with multiple programs and were key interviewees.

AENV provided an introduction to the project and the Matrix Project Team, along with the interview timeline, to the proposed interviewees. Matrix followed the introduction with a phone call in late December to set up an interview in January 2006. Interviewees were supplied with a

question guide covering the information required for the inventory and needs assessment (Appendix C).

Matrix personnel interviewed twenty-six people over three weeks in January 2006. They included nineteen employees of AENV in five different Alberta Environment offices, one representative each from the EUB, the Natural Resources Conservation Board (NRCB), the Alberta Research Council (ARC), oil sands industry and SRD, and two independent consultants.

2.2 Survey and Workshops

A second information-gathering phase was initiated after the interviews were complete and consisted of an on-line survey (Appendix B) and workshops that were held in Calgary and Edmonton. Prior to the workshops, a survey was developed by the AENV and Matrix Team members and sent out by AENV along with the invitation to the workshop. The purpose of the survey was to identify the land monitoring needs of the participants, the interaction with and needs they have from AENV land monitoring programs, and to identify gaps in programs. An on-line survey format was used and AENV received and compiled the response information. Matrix used the survey information along with the interview information for presentation purposes at the workshops (Appendix B), and the information has been incorporated into this report and summarized in Sections 4 and 5.

The workshops were an opportunity to bring together external and internal AENV stakeholders of the land monitoring programs; however, stakeholder consultation was not a primary purpose of the project. The workshop agenda was discussed extensively between the AENV and Matrix team members and had a future focus; i.e., discussion of the potential roles for AENV in land monitoring and identification of opportunities and limitations in land monitoring including partnership delivery of land monitoring programs. Invitees to the workshops included representatives from AENV, SRD, AAFRD, watershed management committees, industry association representatives, federal government representatives, and independent consultants. A list of those invited to the workshops and those who attended is included along with the summary of the survey and workshops in Appendix B.

The workshops were held in Calgary on February 9 and Edmonton on February 10, 2006. The workshop in Calgary was held in the AENV office at Deerfoot Square and the Edmonton workshop was held in the AENV office at Oxbridge Place.

2.3 Interim Report

A draft interim report was issued on February 24, 2006, consisting of the inventory of land monitoring programs generated through the interviews, a list and assessment of the outcomes of those programs, and an assessment of the programs as they relate to the strategic initiatives within AENV, such as the SREM. Members of the AENV LMT reviewed the interim report and comments were received and incorporated by Matrix. The report is included as Appendix C in this final report, and the information is used throughout this report.

3.0 THE LAND MONITORING CONTEXT FOR ALBERTA ENVIRONMENT

3.1 Alberta Environment Land Monitoring Scope

The mandate for land management in the Government of Alberta resides in multiple ministries including Sustainable Resource Development, Municipal Affairs, Alberta Agriculture, Food and Rural Development, Community Development, Energy and AENV. AENV's mandate is derived from the Environmental Protection and Enhancement Act (EPEA) and is strong with regard to regulatory requirements for land under development requiring approvals, and the regulatory mandate extends to reclamation of industrial sites. However, the regulatory mandate of AENV is for sites on specified public and private lands, and SRD administers the reclamation and remediation programs on public land. Beyond regulatory requirements, AENV's mandate for land is a small portion of the overall land mandate in the province.

The AENV business plan does identify effective monitoring programs for land as a deliverable (AENV business plan is discussed in greater detail in Appendix C). However, the fractured nature of the land mandate makes it difficult for AENV to establish monitoring programs related to land initiatives other than in the regulatory framework, since the management of the initiative likely resides in another department.

AENV business plan does identify key land initiatives that are largely cross ministry in scope. Therefore, AENV's land monitoring programs need to provide support to other departments. The process to do so must be created, but would fit well within the department's commitment to the Sustainable Resource and Environmental Management Framework (SREM). The SREM is an initiative to take a systems approach to cross-ministry administration in areas where multiple jurisdictions manage similar or related mandates.

For AENV, the administration of the Water Act (1999) and EPEA is clearly within the department mandate, and these two areas have more strongly developed processes of issue identification and management initiatives. A clear opportunity exists to link land related issues and outcomes to watershed planning initiatives, and potentially to airshed monitoring programs. The existing water related monitoring is heavily focused on water quality and quantity, both of which are impacted by land use.

The profile of land management within the AENV 2006 – 2009 business plan is most strongly linked to four areas:

- regulatory requirements for remediation and reclamation;
- support of partners through SREM;
- the Land Use Framework for Alberta (LUFA); and
- place based management initiatives that recognize natural boundaries for land and water, such as watershed planning initiatives within the *Water for Life* Strategy and the SASS.

These four areas represent the broad strategies within the current AENV mandate where land is a significant component and where the LMT can focus its efforts for future land monitoring programs. The focus within AENV is on supporting the LUFA, watershed planning and management, on strategic and sustainability initiatives such as the SASS, and on support for cross-ministry liaisons through SREM. Each of these has requirements for land related knowledge, and will have requirements for land monitoring; however, the knowledge base to support these initiatives is fragmented, poorly documented and poorly utilized for evaluation of cause and effect modelling. As well, the process and systems required to work with the groups managing the initiatives has not been established.

There is also an emphasis on developing programs within partnerships and working on land related issues within established partnerships.

3.1.1 Place Based Management Initiatives

Large scale, place based strategic initiatives within AENV include the Watershed Planning and Advisory Councils (WPACs), SASS and the Mineable Oil Sands Strategy (MOSS). SASS is a multi-phase initiative to develop planning frameworks for southern Alberta that recognize constraints in land use. Phase I has evaluated land cover and land use footprints, and modeled scenarios related to future footprint changes to develop a framework for evaluating constraints and opportunities for sustainable development. Proposed future work will consult Albertans about the values they hold for various land uses and the difficult decisions to be made concerning constraints to land use, land quality and land quantity. It will also develop a framework for managing desired outcomes when priorities conflict. This initiative continues to require information on the condition and state of land cover, land use and impact from separate uses, foot print, cumulative effects modelling, and constraints management modelling. The kind of information needed, the ability to find and access the data sets, and the quality of the data sets were all limitations to accurate representation of land in the models.

MOSS provides a framework for development of mineable oil sands in the northeast corner of Alberta. It identifies monitoring and reclamation as key components of mineable oil sands development. The development of oil sands through mines or steam assisted gravity drainage (SAGD) projects has created a base of information submitted in several Environmental Impact Assessments (EIAs). Evaluation of the EIA data and cumulative effects evaluations already submitted is an opportunity for directing future monitoring in acid deposition and reclamation. The Strategic Environmental Assessment (SEA) process used in Europe continues to follow multiple indicators through monitoring programs, and can integrate social, economic and environmental monitoring (Appendix E). The format may be useful in modelling for the Athabasca oil sands, as it enables the inclusion of social indicators in cumulative effects modelling. Social infrastructure needs have been identified as a constraint to resource development in the area (RIWG, 2005).

Coal Bed Methane (CBM) development is the subject of a groundwater review by AENV in response to landowner concern over the shallow wells used in CBM development. Potential for surface land damage and significant fragmentation of the landscape are also concerns. The concentration and speed of development, the number of companies involved and the concerns of landowners over fragmentation and potential release of water to the surface soil makes this issue a candidate for immediate place based land monitoring and management initiatives by AENV. The province has already committed to a groundwater study related to CBM. The needs for land monitoring with respect to CBM have not been identified as yet, nor coordinated with the groundwater study.

3.1.1.1 *Watershed Planning and Advisory Councils (WPACs)*

The establishment of WPACs is a strong initiative in the business plan linked to the *Water for Life* strategy. A WPAC is a multi-stakeholder group working in an advisory fashion to implement adaptive management of water basin planning and evaluation (AENV, 2003). The WPACs will work with local watershed stewardship groups that have already been developed. The WPACs report concerns to the Provincial Water Advisory Council, which makes recommendations on water issues to the Government of Alberta.

The outcomes identified for WPACs (AENV, 2003) include:

- reports on the state of the basin;
- watershed management planning recommendations;
- work together with land managers;
- deliver "on the ground" actions
- provide advice and support for a watershed stewardship group; and
- represent the watershed to the Provincial Water Advisory Council (PWAC).

The outcomes related to stewardship groups include:

- actions "on the ground";
- promote use of best practices, collaboration with land use managers;
- state of the sub-basin reports; and

- input to the WPAC and PWAC.

Land use and management play a key role in watershed management as water quality and quantity are strongly affected by land decisions. Integration of land and water outcomes is just beginning for watershed management initiatives.

3.1.2 Cross-Ministry Initiatives

The SREM model is in place to guide work that crosses many government departments such as the LUFA. This is underway, led by SRD, and will seek consultation with Albertans throughout 2006. As with all new initiatives regarding land, key needs identified in the LUFA include access to timely information to support decision-making. The LUFA and other strategies need information on the condition of the land, the footprints of land use, the assessment of relative impact from various land uses, the estimates of the range of natural conditions, and data in a form that scenario modelling can utilize. This information is not easily accessible, as monitoring programs, both in AENV and elsewhere, have not been designed to deliver it.

Information on the condition of the land and pressures on the land is also needed for reporting the State of the Environment (SOE). The SOE report is required by EPEA and part of AENVs mandate and relies on other departments to supply or verify indicator information. In some cases, there is a disconnect between the needs of the reporting team and the needs of the data collection teams. The SOE reporting for land indicators needs to be strongly supported by all government departments in order to provide clear, useful and comprehensive information on the state of the land in Alberta. Collection of the information on the condition of the land is the underlying need for many information users. The SOE report should be a natural extension of the information system developed to reveal the condition of the land. Given that information representing the condition of the province resides in several departments, since it reflects their stewardship of their own land mandate, the SOE process is a natural cross-ministry initiative that fits the SREM model.

3.1.3 Regulatory Requirements

The strongest land mandate within AENV is the regulatory requirement, identified in EPEA and strongly reiterated in the department business plan. High and mid level outcomes have been developed as shown below (LaLonde, 2005). Mid level and program level outcomes should reflect the state or condition of the environment that is desired, and relate to indicators and their natural range of variability, land use issues and management priorities.

High Level Outcomes	Mid Level Outcomes
1. Alberta's environment is clean and safe: Environmental risks are managed and a rapid and coordinated response to environmental emergencies is ensured. 2. The maintenance and enhancement of a healthy natural environment is contributed to. 3. Fulfill approval conditions and duty to report and remediate releases to the environment. 4. **Our vision encompasses all of the following elements**: The quality of air, water and land is assured. 5. The Government is a responsible steward of the province's natural resources. 6. Pollution is controlled and the environment is conserved in the exploration for, processing, developing and transportation of energy resources.	1. Land monitoring programs assure that AENV's regulatory responsibilities are met. 2. Pollution is controlled above, at or below the surface in the drilling of wells and in operations for the production of oil and gas and in other operations (Oil and Gas Conservation Act) 3. Pollution is controlled and the environment is conserved in the development of the coal resources of Alberta (Coal Conservation Act) 4. Pollution is controlled in the development and production of the oil sands resources of Alberta (Oil Sands Conservation Act).

Monitoring related to regulatory requirements remains a key initiative of the land monitoring group within AENV. Monitoring programs provide data from which knowledge products are created; however, a lack of evaluation and assessment of data means that knowledge and trend are not being extracted from the data at this time. Evaluation could be more easily carried out if data were accessed in electronic format. Data evaluation could include mapping on geographical information systems (GIS), links to land use statistics, cumulative effects modelling and evaluation of success in driving remediation and reclamation behaviour to an entire industry rather than to only approval holders. Access to electronic reporting of monitoring program data is needed to support evaluation and development of knowledge products.

The regulatory programs have resulted in the highest profile for AENV with respect to land, and in the production of many land related products such as standards, guidelines and monitoring protocols.

3.2 Current Land Monitoring Programs

Currently AENV has land monitoring programs that fall into five categories:

- regulatory related to reclamation and remediation;
- regulatory related to contaminant releases to industrial sites;
- acid deposition;
- pre-disturbance assessment including EIAs; and
- non-regulatory ambient monitoring.

The programs in these five categories are described in detail in the report and tables of Appendix C, which also contains a selection of other programs existing in the province, administered by groups other than AENV.

The programs in place and the initiatives identified within the AENV business plan and strategies are in alignment only on regulatory requirements. Respondents indicated that all of the programs could be strengthened through continual improvement of standards, guidelines, and criteria; development of codes of practises and best practises in soil handling; post-reclamation evaluation, and detailed evaluation of what equivalent capability is and how it is achieved. The regulatory programs are the clearest mandate for land within AENV, and the focus is on driving behaviour toward self-management in approved industries. This is somewhat driven by limited resources for site-by-site inspection, and the desire to move to an audit based system. However, the programs remain tied to fulfilling the regulatory requirements set out by the EPEA.

The regulatory programs currently in place produce point source data, except for some minimal cumulative effects evaluation in EIAs. It is not known if these data sets can be translated to tell a regional or place based story. Most respondents indicated a need for land use information and for methods to evaluate land management decisions made by land users. The current

programs are designed to support the site-by-site regulation of resource use, not the wider management initiatives envisioned for the future.

The two current ambient monitoring programs have potential to be used in conjunction with some of the water quality indicators included in the AENV business plan, since metals, nutrients and pesticides in water are included as a performance measure in water monitoring programs. The data that the programs collect may not be fully utilizable in connection with the water quality performance measures. Linking these two land programs to the water quality program is an important step since land use is a critical aspect of water quality. If the ambient programs do not support one of the major business plan initiatives, such as LUFA or regulatory requirements or watershed planning, then they need to be revamped to do so.

3.3 Alberta Environment Land Monitoring Products and Services

Monitoring provides two products - raw data and value added information products. Data are the raw output of monitoring programs, while information packages are the result of evaluation of data. Data and information products become the goods and services of the monitoring program, depending on the needs of those using the product. All respondents identified the great need for data and information, and a frustration over the difficulties of finding or using existing data. Land data are not currently reported to AENV in electronic format, and are stored in regional offices where the report review is undertaken. Land data such as chemical and physical soil data have not been evaluated for compatibility, validity, methodological similarity, or other data constraints.

AENV information products include the following:

- Standards, guidelines, criteria, third party audit systems and professional signoff guidelines. Knowledge products also include some Codes of Practises.

- Methodology and protocols for monitoring programs.

- Trends derived from long-term data sets (acid deposition monitoring) and estimation of natural variability in data (metals program).

- A consultation process as developed through industry consultation over guidelines and criteria in the contaminated sites and remediation and reclamation programs.

- Cumulative effects evaluations collected through EIAs. These evaluations are currently un-inventoried and largely unpackaged as an information tool, such as footprint mapping or cumulative effects mapping. Data have not been collected or managed to support regional or provincial scale initiatives.

- The regulatory process which is well understood by industry, with only a few instances of use of legal recourse cited during the interviews.

- Data collected in paper form (although current data sets are unconsolidated), and not easily extracted for evaluation.

The following information products were identified by respondents as requirements or potential expectations that they have of AENV:

- Inventories of data sets and knowledge products.

- Inventories of initiatives in land management.

- Stewardship knowledge of the extent to which behaviour change has been driven within an industry related to management of releases to the environment.

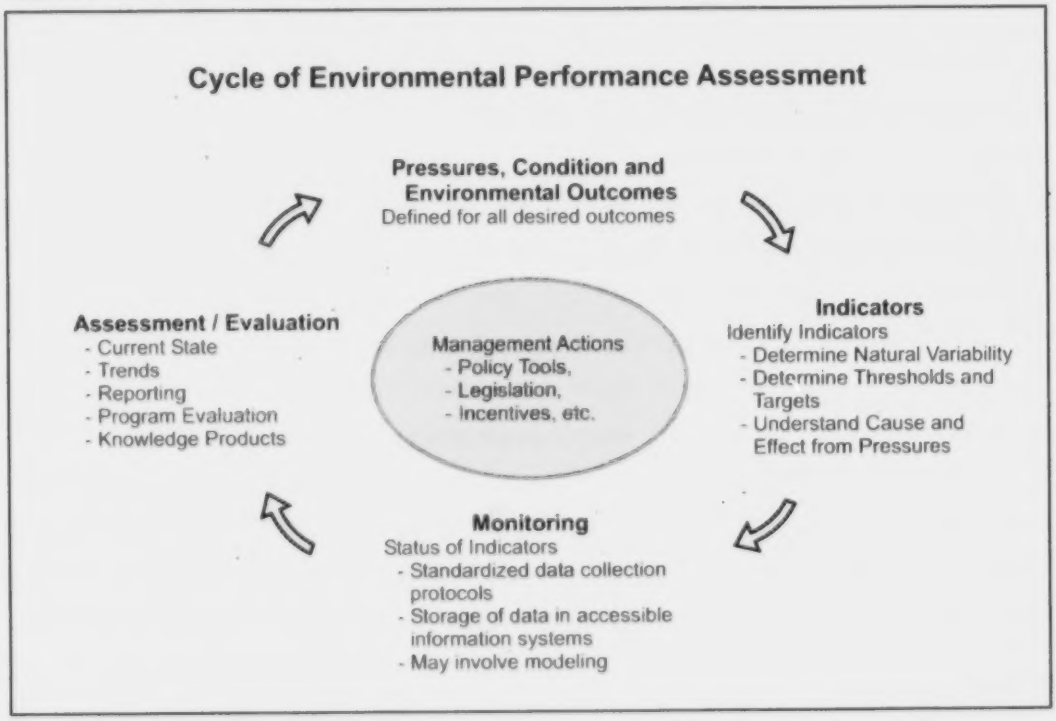
- Best practises guides, guidelines, criteria and standards that span multiple users (non-industry specific) so that application of these standards is widespread and not industry or approval dependent.

- Information products related to indicators of land quality, variation in the natural quality of the indicator, and identification of management objectives and trigger points.

3.4 Modelling Environmental Performance

Ideally, monitoring programs are part of a cycle of planning and management of environmental performance rather than developed in an ad hoc fashion. Measuring and managing environmental performance is an iterative process that links pressures and condition of the land with outcomes, indicators, monitoring and evaluation and assessment. A common framework used in many jurisdictions around the world for managing this environmental performance cycle is the Pressure-State-Response (PSR) framework or one of several modifications of the PSR framework (FAO, 2005). Alberta Environment has embraced a version of the PSR, as represented below.

Figure 3.4.1 - Environmental Management Performance Assessment



The goal of land management is to achieve desired outcomes through management initiatives. For the government, these may include policy, legislation, incentives, and compliance consequences. For other partners, the management initiatives may be education, stewardship initiatives, designation of land to conservation, and many others. One of the key components of

the cycle for the LMT is the knowledge products developed through development of monitoring programs and assessment of monitoring data.

Key aspects to the successful measurement of environmental management performance for land include:

- Identification of the current condition of the land and indicators that reveal changes to land quality.

- Identification of pressures from land use and the cause and effect of different land use on condition. Society sets goals and objectives for land quality that are translated to outcomes or endpoints for the desired level of land quality to be maintained during and after land use.

- Tools in place or developed to support reaching outcomes and targets, such as knowledge of thresholds, management initiatives, research, regulation.

- Implementation of programs to deliver environmental management, ideally delivered in multi-stakeholder partnerships with accountability to various members.

- Monitoring and evaluation of the success of the programs, and report findings.

- Re-evaluation of the program and adjustment as necessary to achieve outcomes.

Monitoring programs developed within this management framework are more powerful tools in land management, and can be developed to support integrated land management. The management framework can be developed for provincial, regional and sub-regional outcomes.

4.0 FUTURE LAND MONITORING NEEDS FOR ALBERTA ENVIRONMENT

Interviewees, survey respondents and workshop attendees were asked to give their thoughts on the future focus for AENV's land monitoring programs, and on the needs of those programs in order to support the new initiatives in AENV and across ministries. An extensive list of needs

was generated and is reported in Appendix D. The list of needs was grouped by focus area for the discussion included in the following sections.

While the respondents identified some direct monitoring needs, they also identified several needs in the broader context of land management. These land management and process related needs are critical to set the context in which effective monitoring programs for new land related initiatives can be designed and implemented in the SREM framework. The needs are at a broad departmental level rather than at a specific team level, and refer to land initiatives of AENV within the delivery model of partnerships and cross ministry initiatives. Therefore, most of the following sections focus on broad departmental needs which the LMT cannot action alone. However, they define the context and structures in which the LMT will be able to effectively action the monitoring opportunities arising in land and watershed initiatives.

4.1 Monitoring Programs and the Land Monitoring Team Structure

4.1.1 Monitoring Program Needs

There are many ideas regarding the information that is needed from land monitoring programs. Needs include Information on land use and land quality trends, sensitivity of land to development, land cover and footprint trends, and tracking of trends in disturbed landscapes. Suggestions for new monitoring programs include the following:

- riparian zone;
- whole watershed monitoring (suggested in literature);
- monitoring of management initiative success in regulatory programs:
  - reclamation success; and
  - contaminant management and reduction;
- landscape monitoring:
  - fragmentation of the landscape;
  - multiple land use monitoring and modelling;
  - footprint monitoring;
  - urban fringe monitoring; and
  - inclusion of landscape indicators in biodiversity monitoring.

The needs for scientific research which relates to or can be delivered through monitoring programs are discussed further in Section 4.11. However, people most commonly responded that developing a monitoring program is a second step following the development of outcomes and indicators relating to the monitored landscape. In the absence of outcomes and indicators, the monitoring programs would be ad hoc. The development of outcomes and indicators is a large scope of work. As well, the development of monitoring programs is seen as a partnership initiative, either with other departments or within AENV divisions, and initiating any new monitoring programs will require a process to consult potential partners and data users.

Other groups in the province are also conducting monitoring and an inventory of other land monitoring programs in the province is needed.

4.1.2 Land Monitoring Team Structure

A key evaluation is to determine the structure and resources the land monitoring team will need in order to be an effective contributor within the cross ministry, place-based initiatives. Currently, the LMT role is additional to the core work of the members' jobs, and the preparatory work needed to develop new monitoring programs for the new land initiatives will be additional to current workloads. The team sees its future as assuring that monitoring is taking place and the environmental management system is functioning, rather than solely proposing monitoring programs. This is a much broader perspective, and the LMT members are enthusiastic about the new opportunities, but need support from many other AENV groups to be able to action the opportunities.

As well, the LMT needs recognized processes in place so that they can initiate the support for new monitoring related work such as creation of inventories of land monitoring programs, identifying monitoring needs in place based initiatives, or evaluation of data collections. For instance, the LMT should be a natural partner in any new monitoring work related to watersheds, and should be able to initiate contact with the AENV representatives to a WPAC. Currently, the WPAC would typically identify the need for monitoring and the LMT might not be involved. Changing the role of the LMT to an initiator of partnership opportunities in land monitoring will require processes and broad support within the department. Promoting

managerial support for the land monitoring initiatives is necessary, through presenting the value proposition related to land information needs of both AENV and partners.

The LMT must determine what monitoring and information needs it can meet in cross-ministry initiatives, so it must be involved in evaluation of current AENV data and programs against future needs, alternative delivery modes, data capture requirements for predictive modelling needs and partner needs. Again, these are multi-participant projects and the LMT cannot action these alone, but has a strong contribution to make once the processes of working between departments and initiating new work are in place.

4.2 Identification of Land Pressures, Condition and Stewardship

The ideal world of monitoring is not easily established as issues tend to come to public attention and need quick response but the mechanism for consulting the public is time consuming. All respondents indicated that one of the keys to building information systems and monitoring programs is the identification and understanding of land use pressures on land condition and the societal values for land in different uses (trade-off or constraint values).

Within AENV, there is no established framework in which land monitoring work relates to the larger issues of pressures on land, except in the regulatory requirement areas, so there is no link between land monitoring programs and management initiatives related to achieving environmental outcomes. The land, air or water issues capture and focus the public attention and represent the areas in which the public looks to AENV for information and leadership, and to help define the desired outcomes. The desired outcomes describe a condition of the land that is desired by the public. New monitoring programs should measure the condition of the indicator of the outcome and reveal thresholds that identify changes from the desired outcome.

All respondents identified the need for information on the condition of land in Alberta. As well, information on the effect of land use on the condition of the land is not well documented for many of the land uses in Alberta, but is critical for planning for environmental performance management. This type of information will be important in the LUFA evaluation and SOE reporting.

Data sets that provide information on land use footprints in Alberta are limited or proprietary and not easily accessed for public evaluation. The SASS initiative created an estimate of the condition of the land related to land uses in southern Alberta from several different databases, and modelled the potential impact from expansion of the footprints of land use. As more data sets become available the accuracy of modelling the condition and pressure over time will improve. Further work is needed to identify or establish the databases that reveal condition of the land provincially, regionally and on a watershed basis, and to establish the affect of different land uses on the condition of the land. This is a major information need for the LUFA, and AENV may need to develop monitoring programs to provide information on condition and cause and effect of land uses to land condition.

4.3 Outcomes, Indicators, and Performance Measures

4.3.1 Outcomes for Land

Outcomes describe the desired condition of the land that would result from management initiatives. To be effective in supporting the new land and water management initiatives in the province, a hierarchy of outcomes is needed, linked to the issues for which indicators and monitoring become established. For instance, resource development and residential development create fragmentation of the landscape, but the desired outcome for land quality that is monitored by measuring fragmentation of the landscape has not been determined. That is, the effect of fragmentation on quality of the land has not been established for Alberta.

Ideally, outcomes will be defined at the short term, medium term and long-term levels, linking high-level strategy to detailed programs such as land monitoring programs and specific site-by-site data. The outcomes for the land monitoring programs in place are generally detail level outcomes which describe a short-term output from the program, but can be linked to higher-level outcomes which are included in AENV's and other departments' vision statements, documents of strategic direction, and business plans (Appendix C). One of the risks is that several high-level outcomes may be unsupported by lower level outcomes and programs related to the outcomes, effectively promising something that the department is not delivering.

Until recently, medium level outcomes, which would foster program evaluation and behavioural analysis, were missing from the cascade of outcomes. Recently, three land monitoring outcomes at a medium term and level have been identified by AENV:

- Land monitoring programs assure that AENV is able to measure performance in achieving defined outcomes for environmental management.

- Land monitoring provides accurate and timely information to support SREM; our partners' decision making is guided by quality land monitoring information.

- Land monitoring programs assure that AENV's regulatory responsibilities are met.

The current monitoring programs and their outcomes are strongly linked to the broad regulatory mandate established in EPEA and to the medium term regulatory outcome listed above. However, with the current format of data collection and the lack of coordinated evaluation on a program and regional basis, they cannot be easily used to determine effectiveness of policy and of institutionalization of environmental management in monitored landscapes. Resources are needed to evaluate the data already collected against the regulatory outcomes expected.

In several of the land monitoring programs within AENV, clear outcomes and consequences were not established before monitoring was put in place. Some of the programs have the potential to be used for predictive modelling, but have been initiated without the model parameters being developed, so may not provide useful information for cumulative effects monitoring or place based management.

Interviewees were asked to give some examples of desired outcomes of future land monitoring programs and the results reflect a range from high level to detail level outcomes (Table 3.4.1). These outcomes are also highly linked to the interviewee's desired focus of future land monitoring.

Table 3.4.1 - Outcomes Identified by Interviewees

High Level Outcomes
• Understand the state of the land • Maintain ecological function • Focus on priority areas and issues • Create a vision of what we want our land to be like in Alberta • Quality of life is maintained • The public is assured of stewardship and has confidence in information and conclusions • Land management is defined and measured
Mid Level Outcomes
• Move to a regional basis in regulatory requirements • Effect behavioural change related to impacts to land quality • Evaluate stresses to land, make judgements, provoke action and change behaviour • Information and evaluation is available to the public • Stewardship, best practises and incentives are established
Detail Level Outcomes
• Knowledge systems and output are in place; awareness and understanding in the public • Fill in the blanks on reclamation process, such as surface hydrology criteria, and time needed to reach equivalent land capability • Ensure resource extraction operations return land to a productive land capability • Reduction in contaminated sites • Less land consumed by urban sprawl • Reduce releases to the land

Outcomes also need to be prioritized. It may not be necessary to develop a long list of possible outcomes, except at the detail level where they are very strongly related to program delivery. At the mid and high level, less is probably more, particularly as the outcomes for AENV land monitoring need to be aligned with those of the water and air monitoring teams as well as those of other departments within the government.

4.3.2 Indicators

An indicator is a parameter that, when measured, reveals a change to the condition of the land and the achievement of an outcome. By monitoring it, the condition of the land can be established at a point in time (baseline) and environmental performance related to management action can be assessed over time. Performance can then be extrapolated to measure whether policy and other tools are effective.

While the interviews and workshops did not ask directly for indicators of importance for land management in Alberta, several of the responses listed as outcomes are really indicators. These include:

- fragmentation percentage over time;
- footprint of land use over time;
- linear disturbance per hectare;
- land cover type over time by Ecoregion;
- percentage of land base in protective status, open status, urban and industrial status;
- number of contaminated sites in the province;
- number of contaminated sites compared to industrial leases; and
- chemical releases exceeding guidelines over time in a geographical area.

As well, significant indicator work has been done in other jurisdictions and many models exist for choosing indicators germane to the issues and outcomes identified.

4.3.3 Performance Measures

An integral component of an environmental management system, particularly in the context of continuous improvement, is a measurement or mechanism to determine if the expected results are achieved. The management program is developed to fulfill a need and produce an outcome. The desired outcome must be clearly defined so that it is possible to determine through performance measures and indicators the extent to which the program is being successful. Indicators are measures that will demonstrate the occurrence of change from a

baseline condition. They must be directly related to the result they are measuring and, if possible, should be quantitative.

There are numerous attributes to a reliable and actionable performance measurement system. Some of the attributes most relevant to AENV's land monitoring programs include the following:

- Performance measures and indicators must be reliable; i.e., they must be able to provide consistent information (replicable) for use in comparison to previous measures.

- Quantitative measures are preferable to qualitative measures; therefore, variables that can be measured or calculated should be selected.

- Measures and indicators must be representative of, and central to, the outcome in question and reasonably easy to interpret.

- The collection of information/data to derive the performance measure must be cost-effective for the purpose intended and relevant to the level of the outcome within the results chain. The measure should provide information and insight that will be useful to decision makers.

Performance measures can be defined for administrative evaluation as well as environmental program performance. Environmental performance measures are the method by which we describe how the land outcome will be achieved. Interviewees identified a list of performance measures, included in Appendix D; however, there was confusion over what a performance measure was and how it would be described. Many respondents identified indicators as performance measures. There was generally confusion over the definition of outcomes, performance measures and indicators and the definitions need to be revisited in each partnership initiative.

Possible environmental performance measures that relate to current and future land outcomes for the land monitoring team are presented below.

Table 4.3.1 - Possible Performance Mesures for Land Team Outcomes

Environmental Outcome	Performance Measure	Indicators
Land monitoring programs assure that AENV's regulatory responsibilities are met.	Reclamation of industrial sites is undertaken by industry in a timely and appropriate fashion.	1. Percent of licensee liability rating (LLR) reviews rejected due to abandoned sites at greater than allowed levels. 2. Number of applications received. 3. Number of applications approved. 4. Percent of audits meeting inspection.
Assurance that legislation/criteria/ guidelines are protective of Alberta's environment.		1. Percent of times that current guidelines and standards are met. 2. Number of approval exceedances per geographical area.
Reclaimed lands meet Equivalent Land Capability (ELC).	Benchmarks of equivalent capability are established for reclaimed lands in different ecosystems.	1. Vegetative quality and quantity is equivalent on and off reclaimed lands. 2. Surface water flow and penetration is equivalent on and off reclaimed lands. 3. Surface soil depth is equivalent on and off reclaimed lands. 4. Erosion sensitivity is equivalent on and off reclaimed lands.
Releases of contaminants to the environment are controlled and remediated, and impact is reduced through effective behavioural change.	Releases and remediation are reported and available electronically, and evaluated on a geographical and time basis.	1. Number of days between release and remediation completion. 2. Number of releases per company per watershed. 3. Number of releases impacting water bodies or riparian zones. 4. Number of releases on coarse grained soil. 5. With potential impact to groundwater. 6. Number of contaminated sites in the province and as a percent of industrial leases.

Environmental Outcome	Performance Measure	Indicators
Land Monitoring programs assure that AENV is able to measure performance in achieving defined outcomes for environmental management.	Environmental outcomes, indicators and thresholds for land types and uses are established at provincial, regional and subregional scales. Monitoring programs are in place that measure priority land uses and outcomes.	1. Very specific by land type and use.
Land monitoring provides accurate and timely information to support SREM; our partners' decision making is guided by quality land monitoring information.	The State of the Environment report for land provides accurate and timely provincial, regional and sub-regional information on pressure, condition and stewardship of land throughout Alberta.	1. Indicators are updated on a timely basis 2. Number of users of the SOE report increases 3. Number of decisions referencing SOE information
	Information is available electronically and in useful information packages.	1. Percent of suitable available data represented in a GIS. 2. Requests for information are increasing. 3. Predictive models are fed by AENV generated land information. 4. Land information products are accessed by partners.
	Partnerships utilize monitoring data in program evaluation and development of management initiatives.	1. Percent of AENV partnerships that deliver land monitoring programs. 2. AENV land information products are accessed by partners' 3. WPAC land related planning and monitoring relies on AENV land information or monitoring expertise.
Albertans have access to public lands for multiple uses. Access and infrastructure does not adversely affect land quality or quantity.	Process in place to plan and rationalize access is in place provincially, regionally and sub-regionally.	1. Reduction of number of different specifications for roads in different industries. 2. Municipalities have aligned and reduced different specifications for all access. 3. Linear disturbance as a % of land base.
River water quality and quantity is assured.	Benchmarks are established for cause and effect relationships of different land uses to water quality and quantity.	1. Water quality index for pesticides. 2. Domestic sales of pesticides in urban centres. 3. Number of integrated land and water monitoring programs.

4.3.4 Planning Framework

A planning matrix or framework will be essential to manage all of the initiatives and knowledge in each of the component areas of the land management and planning cycle. Organizing all of the pieces of the land management puzzle into a matrix provides a planning tool that will help the LMT define their contribution to the LUFA, WPACs, MOSS and SASS.

A matrix has been developed and included in Appendix F that provides a summary of responses gathered in this project and organized to identify:

- issues and outcomes currently being worked on or soon to be worked on;
- what monitoring supports the issues identified;
- what indicators are in place;
- what partnerships could support getting the information needed;
- what knowledge products are in place; and
- gaps and opportunities where outcomes, indicators, monitoring programs, knowledge products and other components of land management planning have not been identified.

Utilizing the planning matrix will help to optimize AENV's resources and potential contribution to SREM initiatives by focusing on gaps and on needs of partners. Prioritization may be based on funding requirements, time requirements by AENV staff, quality and quantity of data and information products that can be generated, breadth of support to partners from any one program, and elimination of duplication.

4.4 Sustainable Resource and Environmental Management

4.4.1 Sustainable Resource and Environmental Management

SREM provides the context in which the diverse government land mandates can be aligned toward common outcomes and policy, and can produce cohesive government management strategies. The commitment to SREM is a commitment to work across silos of management and requires alignment of outcomes and developing a system to deliver on those outcomes.

Within AENV the outcomes related to land are weak. However, through the SREM process, outcomes identified by AENV related to broader land issues can be evolved with partners.

SREM has the potential to improve a number of AENV initiatives such as State of the Environment reporting and WPAC development. For instance, developing WPACs in northern watersheds will require partnerships with SRD, forestry and resource extraction companies, and other stakeholders. The opportunity exists to align the outcomes and knowledge systems needed to describe the condition of and pressures to the land and integrate it with water quality metrics. Determining effective indicators that reveal management changes on complex landscapes requires significant input from all parties. Working together to align outcomes, choose indicators and performance measures, and provide monitoring will create knowledge to integrate resource management initiatives within the WPAC. As well, the land use framework is being led by SRD and will require support from AENV for information on impact from land use and developing outcomes, indicators, performance measures and potential monitoring needs.

The ability to work within the SREM model was not well understood by respondents. AENV can also provide effective support to SREM initiatives through contribution to: predictive modelling, reporting on the State of the Environment, alignment of indicators, and evaluation of monitoring performance across ministries. Two aspects of SREM are strong entry points for AENV land monitoring: the regulatory regime and knowledge systems. Information and knowledge are the clear needs for all respondents and AENV land monitoring has developed knowledge products of use to partners. As well, the regulatory regime is strongly developed within AENV and well understood by regulated industries. The move to professional sign off and third party assurance is a clear partnership activity that AENV is engaged in. One of the basic needs of the monitoring programs is to evaluate the success of the regulatory regime in driving behaviour beyond regulated industry sites, which requires evaluation of data and knowledge. The flexible delivery that may be required to ensure behavioural changes beyond the regulated sites is another opportunity for the LMT within SREM. The LMT can help design performance assessment of both the program and policy effectiveness, and the environmental condition resulting from management initiatives.

4.4.1.1 *The Land Use Framework*

A cross-ministry LUFA is under development in 2005 and 2006, led by SRD through the SREM office. The team is establishing its processes and determining the land use issue it will focus on. The strongest response from workshops, survey and interviews was that land use is integral to land quality and that information is needed to be able to understand pressures and condition of the land related to land use. Intensity of land use impact and sensitivity of land to impact are information needs identified in this project.

What can AENV offer to the LUFA? One of the primary needs of any initiative that looks at land use is information on types and extent of uses and land cover. AENV has an inventory of some land use types for some areas of the province, developed through the SASS process and the EIA process. AENV also undertook a large-scale provincial consultation through the *Water for Life* strategy, and can offer process and system expertise in the LUFA development. AENV may also be able to pioneer an integrated approach to land, air and water monitoring or information sharing within the LUFA.

4.4.2 A Champion for Land

There is a need for a leadership or champion's role for land within AENV at the most basic level to ensure that the needs of the regulatory monitoring groups, watershed groups, other strategic initiatives and the LUFA can be met. Working within the SREM framework requires AENV to be prepared for cross ministry initiatives with strong knowledge products, processes to work with other ministries and partners, and clear planning and direction on the needs AENV has with respect to land management and monitoring. This will require that resources be dedicated to the land issues and information needs identified, including monitoring program design and development.

Leadership is also required to take the SOE framework to the point where the report is a valued information source. This was identified as a primary need for survey and workshop respondents that AENV should fill.

4.5 Regulatory Requirements

Almost everyone interviewed agreed that AENV is recognized for its regulatory role and can offer significant value to land users and partnerships through focusing on tools such as standards, guidelines, best practises, and Codes of Practises. Respondents indicated that these tools should be strengthened to promote cross-industry equality in expectations for land quality during and after a temporary land use. Ensuring equivalency in standards for assessing contaminant impact or reclamation would be useful in standardizing contaminant and land reclamation management across industries; e.g., standardization of assessment criteria for parameters such as electrical conductivity and nitrogen from wastes in confined feeding operations versus impacts at fertilizer plants versus drilling wastes from the petroleum resource industry.

As well, the aim of regulatory programs is to assure a level of land management that meets the outcomes for contaminant and reclamation issues. However, they are limited to approved sites, which limits the ability to understand if land management changes provoked by regulatory requirements are widely adopted throughout non-regulated industries, through example. The regulatory programs should be evaluated to determine if there are mechanisms to drive contaminant and reclamation management on all industrial sites, not just the approved sites; e.g., Codes of Practise governing soil handling in all land uses.

The extent of land use covered by AENV regulatory programs is limited by:

- the limited number of sites with regulatory approvals in the province,
- the current governance structure for land in the province, and
- a lack of conservation focused programs.

The liaison between SRD and AENV over reclamation in the green zone could be strengthened, based on issue identification and SRD needs assessment. The inherent strength of the contaminant and reclamation programs is that eventually all sites must be reclaimed to AENV standards and guidelines. Theoretically, all industrial sites are captured within a program. However, the only industry in which an operational consequence exists related to reclamation requirements is the oil and gas industry (through the licensee liability rating coordinated by the

EUB). AENV should evaluate other potential management consequences that might attach to other industrial uses of the land or quality of reclamation.

The weakness of the regulatory programs is in the level of understanding of the condition of the land with respect to industrial land use, or effect on land quality from different land uses and land management strategies. A number of parameters were identified under the need for more scientific research (Section 5.10), which largely relate to understanding the relationship between land use, reclamation management and land quality. Even the extent of industrial land use is not clearly understood. The output of this research should be focused on development and improvement of standards, criteria and guidelines for land management programs.

4.6 Municipalities and Other Ministries' Land Mandates

Four other critical jurisdictions for land in Alberta are AAFRD, Alberta Energy, SRD and individual counties and municipalities. Municipal Affairs may also be a point of contact for AENV, but AENV should begin a discussion with the three organizations that represent urban and rural municipalities in the province:

- the Alberta Association of Municipal Districts and Counties,
- the Alberta urban Municipalities Association, and
- the Alberta Rural Municipal Administrators Association.

These groups offer tools and services to their members and are well positioned to enter the land issue and land use debate. These groups may already have ideas on land monitoring needs and tools for their members, to which AENV can contribute.

AAFRD has a mandate related to land quality and land management on agricultural lands in the White Zone. Since land issues often cross private and public interests, there is a need to engage private landowners in land management initiatives. AENV should work with AAFRD to expand AENV influence across private land. An example would be a program developed along the lines of the Environmental Farm Plan, but that addresses non-regulated industrial land use on private land.

4.7 Data Collection, Management and Evaluation

Inventory of, coordination of access to, and promotion of electronic management of existing and new data sets were needs identified by all participants. Data generated from the land monitoring programs are collected largely through paper reports rather than electronic files, so the development of a database for information now held by AENV is a large task requiring data evaluation, system development and database management. The resource cost of amalgamating existing data may be prohibitive for the value generated. An initial evaluation of the data sets in AENV should focus on the following questions:

- What large issue or modelling initiative can be informed by these data?
- How much of it is compatible between sites, years and industries?
- How useful is it in describing the outcomes and indicators of environmental performance?

Future data could be collected in an electronic format, however, design of the electronic capture and data compatibility are key issues. To design a single successful electronic format might then require a redesign of reporting standards and prescription of data formats from AENV. An alternative is for AENV to access distributed databases maintained by the data managers.

As well, data without interpretation are not generally very useful, so understanding how the data will be used in models and evaluated is critical before any new data capture or reporting requirements are designed. A possible method of data representation is through capture in a GIS so that spatial representation is provided.

A second data related initiative involves inventorying data sets that exist within AENV and the other ministries and partnerships working on land issues. A start has been made through the SASS process that identified eight data sets related to land use footprint and land cover. SRD is also inventorying data sets. Like a database or GIS initiative, this would require dedicated time and resources to establish and maintain.

Access to information was identified as an issue for interviewees and workshop respondents. Data submitted to AENV are public and accessible; however, some date collected in monitoring programs is considered proprietary. Therefore, access is not necessarily available or free.

Creating an independent data set inventory, or portal, would help data users find where information is collected or stored and would become a connection point for users who then choose how to use the data. This portal approach would not require AENV to store or collect all of the actual data sets. An example is the ecological land classification developed by a consultant for northern landscapes, which is offered free to any user, but housed at Alberta Pacific Pulp Mills. An information portal could offer the name of the data set and the proper request procedure for getting the data, without having to house the dataset. Work on creating an information portal for watersheds has begun in the AENV Lethbridge office.

Developing the "question" that data and modelling are designed to answer is the root of evaluation. Evaluation may involve modelling such as cumulative effects modelling, or footprint modelling. One of the areas of the province with the most sources of public data is the oil sands area of northeast Alberta. A framework to evaluate the collective EIA and monitoring data should be developed, particularly in light of MOSS and its land monitoring needs.

4.8 Support of Watershed Planning and Advisory Councils

Watershed environmental management uses a geographical area defined by land features and water flow to organize stewardship and governance. All of the Government of Alberta literature on watershed planning identifies the strong role of land and land management in watershed planning. The AENV business plan includes water quality performance measurements. These include four components related to land management (metals, nutrients, turbidity, pesticides). However, watershed monitoring currently focuses on water quality and quantity monitoring rather than land monitoring. A framework to integrate water and land indicators must be developed. AENV land monitoring currently has two programs that may provide relevant data for evaluation of land use related to this water quality indicator, but the connection has not been explored (Pesticide Sales Inventory and Soil Metals).

A strong framework must be built for integrated management since the economic and social values around constraints to water quality and quantity are being developed. These value systems must necessarily explore the constraints to land use and land management that are linked to water quality and quantity. Understanding the constraints on land use related to achieving a certain water quality is the basis of working with land managers to achieve

integrated resource management. The WPAC framework will require several inputs from AENV land monitoring related inputs to be effective, such as:

- knowledge of effect of land use management on water quality;
- help and advice for stewardship groups;
- reporting expertise;
- identification of land indicators relevant to water quality and from which management behaviour can be isolated; and
- design of monitoring programs and criteria for data evaluation.

Several land monitoring programs have sought to integrate multiple objectives in watershed management or place-based initiatives (U.S. national parks) and that work provides a basis to start from (Appendix E).

A key deliverable of the *Water for Life* strategy is an information centre on water quality and quantity to ensure public access to water information. A key need for watershed planning is information and access to it. Work has begun in AENV to create an electronic portal approach to water related information available in distributed databases. The same approach would be valuable for land related data sets. This provides the opportunity for AENV to become the access point to data sets without requiring AENV to manage the databases.

4.9 State of the Environment

Interviews and workshop responses focused on the SOE report as a primary product that is within AENV's mandate. However, the current SOE report for land was not considered complete or effective because of limited information on indicators of pressures, condition and stewardship. Indicators have been developed from a "what's available" viewpoint, rather than form a "what's needed" viewpoint. This initiative also requires building a value case that can be supported by the Minister and government public relations group, so that valid reporting occurs. By not leading in this area, groups outside of the government (e.g., Pembina Institute for Appropriate Development, 2005) are establishing their own parameters for measurement and reporting. Indicator work from other organizations should be evaluated against AENV's

requirements as it may well contribute to meeting the needs of describing the condition of the land, and may present a partnership opportunity.

4.9.1 State of the Environment Framework and Report

To be effective, the SOE report should be generated from a management framework and process aimed at understanding the condition of the land, the impact from various pressures to the land, and the level of stewardship of the land. Like an annual financial report for a company, the SOE report should fall out of systems built to establish and monitor key indicators of the state of the land base. In this manner, it doesn't matter which department manages a key indicator; just that the knowledge is captured and feeds the report.

Understanding and reporting the condition of the land is understood as fundamental in planning and management initiatives in many jurisdictions from the local level to international (ASPB, Fall 2005). Many different systems have already been developed in Canada and abroad for identifying indicators, reporting on them, and using the information for planning:

- Two-hundred land use issues identified by municipal SOE reports;
- Western Boreal Ecosystem Initiative;
- Provincial SOE reports;
- State of the Basin Reports;
- National Environmental Indicator Series;
- Canadian Council of Forest Ministers Criteria and Indicators of Sustainable Forest Management in Canada reports;
- National Round Table on the Environment and the Economy SOE indicators;
- Agriculture and Agri-Food Canada has 14 indicators it reports on, and
- Collaborative efforts such as the Convention on Biological Diversity and the Organization of Economic Cooperation and Development.

Developing SOE indicators that tell a story of Alberta's land base and quality requires understanding of issues, land uses and other pressures to the land, and being able to report the condition of the land. A land management matrix framework will support this initiative by identifying land issues, what is available for indicators and monitoring data, and what is needed.

Information initiatives for the SOE identified by respondents include an inventory of data sources, inventory of land management initiatives, data models, cause and effect evaluation, land cover and footprint inventories, and stewardship statistics.

The SOE requires a strong cross-ministry process, with support at all levels. It will provide valuable information sources for land managers in several other ministries for whom SOE reporting is not a priority deliverable. To strengthen the SOE framework, the process should start with cross-ministry consultation, led by AENV, to develop a framework which describes the condition, pressures to and stewardship of Alberta's private and public land base. Indicators and information sources can be identified and tracked over time, either by the responsible ministry or AENV. However, each ministry needs to commit to tell the story through the SOE report administered by AENV. Once the cross-ministry team has established the required SOE indicators, AENV land monitoring should undertake an assessment of gaps in information sources for key indicators and manage the information collection process to support the business plan and deliverables of the other ministries. As well, groups outside the government may be gathering information suitable to indicator tracking, and could utilize the SOE as a reporting tool.

4.10 Strategic Decision Frameworks and Predictive Modelling

Strategic decision frameworks like SASS and MOSS require predictive modelling, either of footprints and land uses or of potential contaminant and reclamation impacts. Cumulative effects and ecological effects modelling are methods of predicting type and intensity of impact from land uses. Most monitoring in place now does not support these modelling programs.

The MOSS strategy offers a place based development scenario in which to establish a cumulative effects model. Likewise, land use planning within watersheds is a place-based issue that would benefit from footprint modelling. Information sources are limited or have not been collected or coordinated to support this type of modelling.

An immediate opportunity exists to establish a cumulative effects model around the development of coal bed methane. Although it is one industry, development is underway by many companies that do not have to provide cumulative effects predictions. The area of

development is finite, affects watershed planning, management and multiple stakeholders. The development of integrated land and groundwater predictive modelling should be examined for the coal bed methane development areas as the issues raised by the public relate to intensity of use and changes to surface and ground water and land.

4.11 Communication

A major challenge to effective land monitoring and reduction of duplication is communication across ministries, departments and other levels of government, and to potential partners outside of government who do not know the LMT and its objectives. Some survey and workshop respondents were unaware that AENV land monitoring programs existed. Communication efforts might include:

- promotion of AENV land information products;
- well developed ideas of what AENV needs for it's own land initiatives, as the basis of discussions in cross-ministry and partnership endeavours;
- SOE reporting, and
- teaching and educational tools.

4.12 Science and Research

Respondents to interviews, survey and workshops all indicated that there is still scientific work needed to support or direct monitoring of land indicators. Several areas were identified as requiring further scientific investigation:

- Model the cumulative effects of multi-industry use, related to footprint and land cover information.

- Investigate reclamation, including whether equivalent capability is being met through reclamation, by evaluation of soil handling techniques and developing a post reclamation monitoring program to determine length of time to reach equivalent land capability, and success of various soil handling techniques.

- Identify indicators of land quality, and programs effective in monitoring and trend analysis of these indicators.

- Develop a system to prioritize indicators and maximize monitoring information toward multiple issues and outcomes.

- Identify land changes that occur from land use pressures. Determine the land uses in the province, the extent of the uses, land quality issues related to the uses, and natural variation in land quality parameters.

- Identify thresholds related to land changes. This involves identification of the point at which a trend in land quality is at a critical point within the natural system variability. A point that is less extreme than the threshold is then set as the point at which management intervention is required to avoid reaching the threshold.

- Define the specific links between land use, management and water quality and quantity that relate to both riparian and upland zones, identify indicators of change that can be linked to water quality/quantity indicators, and establish monitoring programs.

- Develop standards, guidelines and criteria that can be used across land uses and industries.

- Continue to investigate soil chemical and physical quality data as it relates to:

  - spatial distribution and natural occurrence;
  - impact from land use; and
  - reclamation success.

5.0 PARTNERSHIP OPPORTUNITIES

Partnership offers the opportunity to share knowledge, responsibility and management of land monitoring with many Albertans. Partnerships exist for many reasons, but in general parties come to a partnership for mutual gain. The relationship demands some reciprocity and partners are expected to bring something to the endeavour. Having a common outcome strengthens the partnership; however, partnerships can function with several different desired outcomes as long as the partners have a process to prioritize the outcomes (Appendix E).

Partnerships can be consensus based or run by a management committee, which makes decisions within an agreed set of values and management structure. In many of the partnerships of interest to AENV, the organization of the partnership may not be initiated by AENV, but AENV may have representatives to the partnership.

For the LMT, the deliverables from a partnership are many and varied. They include shared or alternate funding of data collection, inclusion of land indicators and monitoring in watershed management, access to scientific research, development of predictive models and the ability to work on a broader set of outcomes than is possible internally. The LMT may need to work through other AENV representatives in partnerships rather than initiate the partnership contact.

AENV has several "products" to offer to partnerships: knowledge products such as data sets, guidelines and criteria; monitoring protocols; specialized knowledge and expertise; reporting through the SOE program; historical context; a consultation process; and systems. Potential knowledge products include inventories of land related issues and data sets, available through an information portal. By developing product packages, AENV land monitoring can be prepared to contribute when going into partnership discussion, which will facilitate getting what AENV desires in return. Before entering any partnership, AENV should evaluate what is desired from the partnership, be it data or representation or ability to lead, since each partnership will have a different structure.

In establishing partnerships, the easiest route is to join an existing partnership. If a new partnership is desired, then the first step is to determine what the value proposition is for the

partners since they may have different outcomes and needs than AENV. Possible approaches to partnership and the value proposition would include:

- Inviting stakeholders in a WPAC to design a framework of land outcomes and appropriate land use or quality indicators that align with water quality and quantity outcomes of the WPAC. The value proposition for the WPAC is access to monitoring expertise and streamlining the design process for outcomes and indicators, and integrating monitoring of media.

- Approach an existing partnership such as the Cumulative Environmental Management Association (CEMA) to design a reclamation monitoring framework for reclaimed oil sands mines. The value proposition is pooling efforts toward establishing reclamation benchmarks.

- Approaching conservation agencies to discuss the condition of and pressures to land and design indicators suitable for SOE reporting from existing data. The value proposition is that conservation gains a higher profile in provincial reporting and AENV may not need to initiate a monitoring program. As well, this may pioneer a process of utilizing qualitative or third party data to meet reporting needs.

- Design the framework for outcome and indicator development and SOE reporting development through a cross ministry partnership. The value proposition for other departments is to use their existing monitoring work to choose indicators and to create a complete picture of Alberta land, as well as to have a recognized place to publish indicator results. The value proposition for AENV is to share the SOE indicator development requirements and create a broader picture of Alberta's land resources.

Respondents offered many suggestions on potential partnerships, which are discussed in the following sections.

5.1 Other Alberta Government Departments

Since the land mandate is distributed amongst many departments, obvious opportunity exists for partnerships to bring together the mandates through development of cross ministry outcomes and indicators. This works toward providing the "complete" picture of private and public land in Alberta. This is compatible with the SREM model. Some of the Government of Alberta partners and opportunities for AENV land monitoring are set out below.

- Municipal Affairs may require broad scale tools to understand land indicators and monitoring data, and use that information to influence municipalities with respect to land planning.

- SRD has a mandate for public land and has developed a range health monitoring program, which may contribute a land indicator for establishing condition of rangeland. SRD is also land manager of public lands under forest cover. SRD leads the land use framework and is already a partner with AENV in delivery of reclamation and remediation programs.

- AAFRD has a land mandate related to agricultural land. Private agricultural lands must be brought into the land "picture." AAFRD has 29 reference plots and many years of monitoring soil quality data. Condition of the land indicators may already be developed which are appropriate for SOE reporting. As well, it may be possible to work with AAFRD to develop on-farm indicators of environmental performance, which can be monitored through observation and worked into Environmental Farm Plans. The Alberta Environmental Sustainable Agriculture Council, which has a soil monitoring program, and is a stakeholder council with 29 members.

- The Natural Resources Conservation Board (NRCB) has minimal monitoring requirements related to confined feeding operations, but requires criteria and guidelines for interpretation of monitoring data.

- The EUB is linked to energy resource land uses. AENV and the EUB have developed a link between the Licensee Liability Rating and the reclamation program and should explore with the EUB other mechanisms for driving and measuring land management behaviour. Drilling waste is a current topic of interest in both groups and alignment of purpose and standards in

disposal with reclamation guidelines would aid the industry in up-front planning. The current review underway within AENV of the efficacy of Phase I review in predicting contaminant identification during a Phase II investigation will be of use in discussing this with EUB. Also, working speedily with the EUB to identify the reclamation and remediation efforts likely to be associated with coal bed methane development might improve development guidelines. Further, the ability to map footprint of coal bed methane development is critical, both as a data set for land use planning, and a data set for reclamation, and may be a partnership opportunity with the EUB.

- Relationships with existing partnerships such as CEMA and WPACs could be strengthened. The partnerships envisioned by the development of WPACs require a strong representation from land monitoring data. Watershed planning with respect to land is very new, and not yet encompassing the upland landscape as well as the riparian zone. The LMT, or a larger AENV group such as the Monitoring and Evaluation Branch, could build a high level, generic model of the land issues and associated monitoring needed in any watershed, which would include monitoring protocols, data protocols, and evaluation tools. This "product" would then be modified to suit the outcomes relevant in an individual WPAC, and to link the land indicators with water indicators. The LMT could also work with the air monitoring teams to ensure that land monitoring within airshed groups is relevant to both land quality and water quality issues. For example, the acid deposition plots are not now linked to the airshed monitoring groups in place, except in the Athabasca oil sands area, and could be the basis of partnership endeavour.

5.2 Other Levels of Government

Other levels of government offer opportunities to share data or use data collected in other venues for SOE reporting.

- Federal government departments, particularly the Prairie Farm Rehabilitation Administration and Agriculture and Agri-Food Canada, Environment Canada, and Natural Resources Canada.

- Individual municipalities and counties, and the three associations that represent them all have land use planning needs. Develop toolkits to integrate monitoring programs at the municipal level, as a new knowledge product. Work on land planning toolkits is underway in some municipalities, and this represents a partnership opportunity.

- The Alberta Research Council contributes to the acid deposition monitoring program and may be able to partner in some of the science-related needs or the toolkit development for municipalities and other partners.

- Urban municipalities have great impact on land through footprint, resource use, sprawl, pollution and other impacts. The City of Calgary has a long-term strategic planning initiative called *Imagine Calgary* that may offer partnership opportunities. Likewise, the contaminated site management strategy of the city is developing and opportunities may exist for partnership approaches in defining risk management and reclamation in urban settings, brownfields development standards, and monitoring protocols. The Calgary Regional Partnership is a key group wrestling with aligning outcomes and management related to urban and rural interface around Calgary.

5.3 Academia

A significant partnership exists between Syncrude and the University of Saskatchewan to carry out research on reclaimed landscapes. This enables Syncrude to have access to data and the labour needed to collect it. They use the data to round out their automated monitoring program on reclaimed landscapes.

Many respondents identified the need for further research into determining reclamation success relative to equivalent land capability and to monitoring chemical and physical parameters. The need for data sets on land use footprints and land cover was also identified. A partnership should be sought with one or more universities toward developing a long term reclamation monitoring program. Alberta Environment could contribute knowledge of reclaimed sites, description of the parameters to be evaluated, definition of the "long term question(s)" to be answered, and possibly some money for site lease. Multiple industries might contribute monetarily if the work were done in a "without prejudice" framework toward validation of

reclamation and remediation criteria and guidelines. The university in question would want freedom to design individual research programs, which should be possible as long as they contribute to the very specific end evaluation needed for AENV's purpose. Electronic data capture requirements would need to be defined and agreed to at the beginning of the program.

5.4 Other Groups

- The Nature Conservancy of Canada has an interest in scientific research and may have goals or outcomes to which AENV could contribute to or benefit from. The focus on conservation may provide a basis for initiating conservation monitoring programs within AENV.

- Ducks Unlimited and Cows and Fish are two groups working on local scale riparian projects with a conservancy focus.

- Canadian Association of Petroleum Producers (CAPP) and other industry associations fund research and evaluate policy. Exploring commonly desired outcomes would be critical for this kind of partnership.

- Alberta Biodiversity Monitoring Program is developing landscape indicators to include in the monitoring program. The LMT may have insight into landscape indicators of choice, monitoring programs in place, or standards for developing data criteria. The opportunity for input is immediate as the program may be finalized and funded for 2007.

- Farm associations which provide extension or representation to producers. AENV could explore extension needs related to land monitoring or land quality issues for these groups.

- Voluntary watershed stewardship groups which may not be formally integrated into a WPAC (Primeau, 2005).

- Non-government organizations such as the Pembina Institute for Appropriate Development, who has developed an indicator program and provides broad evaluation of numerous

environmental issues. The opportunity to use already established indicators or issue statements might reduce the work for the LMT.

- Alberta Lake Management Society.

- Alberta Conservation Association.

5.5 Roles and Responsibilities for AENV

What roles are possible for AENV land monitoring personnel? There is the need for a champion for land within AENV, at the most basic level to ensure that the needs of the watershed, strategic and land use planning initiatives can be met. Cross-ministry discussions will only be successful if AENV can go into them knowing what it wants and what it can offer with respect to land information. This will require a strong land monitoring team with resources to dedicate to the opportunities and needs of partners. In particular, the identification of outcomes, indicators and monitoring needs is a key role for the LMT, but one that requires a recognized process for the LMT to initiate, respond to and act on opportunities.

A strong support role is also available to AENV through the development of tools and products, inventorying of information sources and initiatives, and coordination of resources to optimize what is in place in AENV now. This role needs to be developed to make partnerships meaningful for AENV and its partners.

6.0 GAPS, DUPLICATIONS AND BARRIERS TO SUPPORTING NEW LAND INITIATIVES

6.1 Gaps

Data gaps include:

- The monitoring data produced by the current AENV land monitoring programs are largely point source data and cannot be easily translated into regional information.

- Data collection is currently paper based. If electronic collection and GIS representation are going to take place, the requirements for data transfer must be designed first. The reporting requirements for regulatory programs may need to change.

- Evaluation modelling starts with a question related to what we think will happen in the future. Data collection protocols are not currently linked to evaluation models and current data may not help in prediction modelling.

Gaps in organizational structure and scope:

- The mandate for land within AENV is limited, but the scope of need for land related information is large. No process is currently developed that supports AENV generating land information of use to many partners that is not linked to regulatory requirements. This gap is critical to generating partner support.

- The current organizational structure and roles and responsibilities for AENV's land monitoring team will not easily support the broad, multi jurisdictional efforts required by WPACs, the land use framework or other place based initiatives.

Gaps in regulatory programs include:

- There is an apparent inequality of application of land goals and quality requirements among land users; for instance, private owners of agricultural land, corporate owners of agricultural land, CFOs, forestry, oil sands, conventional oil and gas, linear development, residential development, mining, and city expansion.

Gaps in being able to meet societal expectations include:

- Indicators of sustainable development have not been agreed to for Alberta.

- Thresholds that provoke an action related to managing impact to the land have not been identified for environmental performance related to land condition and indicators. In the regulatory programs, there are penalties that can be invoked, but only one link to a

consequence that might drive behaviour. There is a gap in understanding what both society and AENV would do if a negative trend in monitoring data were revealed.

6.2 Duplications

Multiple land management and land monitoring initiatives exist, and often the same people are being asked to work on multiple issues, which causes confusion over the direction of initiatives and frustration over whether the initiatives are linked together and working toward a common end. One respondent indicated that the following list of initiatives his organization is involved in (led by the organization listed in brackets), all with a land related focus, required time and input from members, and were becoming repetitive:

- Integrated Resource Management (SRD);
- Contaminated Sites Review (AENV);
- Depositional issues – the Selenium Working Group in coal mining areas (AENV), mine liability (AENV);
- Integrated Land Management Program (SRD);
- Oil and Gas Reclamation Advisory Committee (AENV);
- Reclamation Criteria Advisory Group (AENV);
- Contaminated Sites Advisory Committee (AENV);
- Cumulative Environmental Management Association (CEMA);
- Regional Strategic Development Strategy (RSDS; coordinated through AENV for EIAs);
- Regional Infrastructure Working Group (Wood Buffalo Environmental Association); and
- Mineable Oil Sands Strategy (Energy/SRD/AENV).

Planning for any regional or place-based initiative, such as a watershed, requires coordination of many different members and can be especially difficult across government departments that share responsibility, but not accountability. Adding land monitoring is one more player to manage and coordinate. There is potential for duplication through poor communications.

Groups outside the government are also doing land monitoring, but with poor links to government input or output. Often they look to the government for information; but, if they are producing it, they do not always feed it to government.

6.3 Barriers to Monitoring Under the SREM System

Barriers are generally larger than can be addressed by the LMT, but the LMT may have some influence on some of the barriers.

Barriers that may be influenced by AENV LMT

- Systems to capture electronic data reports are not in place. Fundamental to the system development is identifying what the data will be turned into. Some work on GIS representation is being done in AENV's Lethbridge office and before any electronic data capture is considered, that group should provide insight into what is needed and can be done. A system to capture data may be useful to trend analysis, but may be so unwieldy that it becomes too cumbersome to use. Evaluate the data needed before designing a system.

- Sharing of information is limited in some cases due to format, methodology of collection, storage of the data, proprietary concerns and privacy concerns. How much data can be accessed with the least cost and most compatibility? Is it useful? Is it sufficient?

- An iterative process to work with partners to identify land pressures, outcomes, thresholds, indicators, condition, etc., is not in place.

- The increased focus on land management within AENV and SREM means that current organizational structures, which are focused on meeting regulatory and approvals needs, may not be sufficient. Many of the new initiatives might require staff to work across existing organizational structures and to initiate new work. Can the current structure support the LMT to work vertically through the identification of issues, assigning of resources, and determining what interface they will have with major initiatives inside AENV and in other groups? If not the LMT, then who should do this?

- While AENV participants identified the need for partnerships, representatives of other agencies did not identify AENV as a strong partner with respect to land initiatives. Therefore, the definition of the value proposition for partners of working with AENV land

monitoring is missing at the beginning of establishing partnerships. The second step is to understand what AENV brings and providing incentives or tools to deliver the value to partners. This is key to dealing with other government departments that have a stronger land mandate than AENV.

- The gap between point source monitoring data and regional, or place based, management initiatives is a barrier to immediate information transfer to these initiatives such as watershed management groups.

- Programs are not now designed to connect land-based indicators and water based indictors, which is a barrier to integrated resource information systems for watershed planning.

- There is a lack of information about land cover, land uses, changes in land uses, societal values for different land uses and indicators of land quality.

Barriers Outside of Alberta Environment Land Monitoring Team Influence

- The amount of resources required to determine the current state of the environment, using both existing and new monitoring programs, is considerable. Prioritization is needed.

- Government department "silos" and diverse land mandates stand in the way of collective, outcome driven land management and associated land monitoring. A collaborative effort requires considerable process design and marketing of the benefits of working together.

- The lack of a cohesive, public "vision" of private and public land as a shared, valuable resource has implications to identifying land issues of importance to the public, defining quality, establishing land use priorities, valuing different uses in a constraint situation, current condition, and conflict resolution.

6.4 Process Development

Process development is key to overcoming gaps, duplications and barriers to developing the opportunities in land monitoring programs. Processes allow a team to work across many different initiatives at any of several levels, since the process of working together is well understood. However, development of the following processes will make it possible for AENV to evaluate how to contribute with the greatest effect through SREM and other initiatives. The LMT is a key contributor to each process but also needs to develop its own process for initiating action on monitoring needs in new land initiatives.

- Develop a process for linking pressures to the land, outcomes and indicators of land management in complex landscapes with many stakeholders. Evaluate monitoring needs within partnerships. Enhance the State of the Environment report from this process.

- Develop a process to work with partners within cross-ministry initiatives, including team processes.

- Develop a process for inventorying land related information or data sets from as many sources as possible, and provide a portal to the data sets.

- Develop a process to assess outside monitoring efforts by disparate groups, and to determine if the information can be used in establishing condition or stewardship of land, and can be reported.

- Develop a process for optimizing efforts – can a single working group address more than one component of the land monitoring and management initiatives currently ongoing?

7.0 RECOMMENDATIONS

1. Direction for New Monitoring Programs - Design of new monitoring projects should focus on land quality, riparian zone assessment, landscape parameters that describe effects of land

use, and reclamation success monitoring. Seek broad partnership opportunities in defining and developing these monitoring programs.

2. Assessment and Evaluation of Data - Evaluate data needs for regulatory and other monitoring programs, and for predictive and cumulative modelling. Also evaluate electronic reporting design, the use of distributed databases and a portal access approach.

3. Development of Processes to Facilitate Land Monitoring Team Programs - Key processes include:

   - Integration of Cross-Jurisdictional Outcomes, Indicators and Programs – Develop processes to integrate outcomes, indicators and monitoring programs within partnerships and across the matrices of water, land and air. This will maximize the opportunities in land monitoring programs.

   - Partnership Protocol – Develop a protocol for working in partnerships so that the LMT is an empowered team contributing to cross ministry initiatives. An example is the partnerships envisioned by the development of WPACs. Watershed planning with respect to land is very new, and will require monitoring programs for riparian and upland landscapes.

   - Management Framework to Support SOE Reporting – Develop a process to enhance the SOE report that derives from a cross ministry management framework that identifies outcomes, indicators, performance measures and related monitoring.

   - Evaluation and Monitoring – Develop a monitoring and assessment process to determine if policy, guidelines, standards and legislation are delivering environmental management behavioural change through regulatory programs.

4. Modelling - Evaluate the needs of cumulative effects and predictive modelling and whether data already collected meets those needs and how future data must be collected to be useful.

5. Best Practises Evaluation - Develop evaluation tools to determine if regulatory programs are driving best management practices throughout industries.

6. Knowledge Products - Focus on creating and strengthening the land related knowledge products developed within AENV.

7. Partnership Initiatives - Pursue partnerships to deliver scientific knowledge related to condition, pressure, stewardship of land, and equivalent land capability.

8. Effective Public Engagement and Awareness - Focus on communication efforts to ensure that the public is aware of environmental performance, and potential partners are aware of AENV land related efforts.

The LMT is enthusiastic about contributing to the new land initiatives, but the LMT operates within a system and department, and effective monitoring requires input from multiple sources. To ensure monitoring meets the needs of new initiatives, the LMT needs the support of partners and other AENV disciplines to ensure the processes are developed and the resources are available to meet the above recommendations.

The following table identifies tasks that Alberta Environment should undertake to fulfil the recommendations and meet the needs identified in this report

Table 7.1 - Suggested Tasks for Process Development

Recommendation	Needs and Gaps Addressed	Suggested Tasks for Process Development	Expected Benefits
Develop processes for working as a land team with other departments and partners in cross ministry initiatives. Build an internal land focused team able to work in partnerships.	The ability to work in cross ministry initiatives is not well developed. A champion is needed for the role of land within AENV. An increased profile for land requires a stronger team development.	Develop the process for the LMT to respond to partnership opportunities as a team: • who responds? • how are decision made? • how is the LMT engaged? • is the LMT a formal group? Develop a process to evaluate indicators and monitoring by third party groups for use in SOE. Develop the value propositions for multiple potential partnerships.	Reduced need for AENV monitoring programs. Ability to act on partnership opportunities. A team able to support major land initiatives.
Focus on the framework to provide detailed pressure, condition and stewardship related land information and SOE reporting.	Provincial and regional information is lacking but required by multiple users including the Land Use Framework, SOE reporting, WPACs, MOSS, and SASS.	Develop a process to work with other ministries in state of the environment reporting. Develop a broad picture of baseline conditions of land quality and sensitivity to impact. Report through the SOE report for land. Develop inventories of: • distributed data bases; • land management initiatives throughout the province; • data models and output useful for cause and effect modelling; • land cover and footprint of land use • stewardship initiatives.	Knowledge of what data we have and still need. Single source identifying data access. Knowledge to design new monitoring programs based on gaps in data sources.
Work within a planning matrix of potential partners, land pressures, conditions, outcomes and indicators, to design monitoring programs to fill the gaps.	Working without a planning framework means the LMT cannot effectively plan to meet the needs of future initiatives.	Determine what gaps in monitoring programs should be filled by AENV or partnership opportunities. Focus on the outcomes and indicators for various conditions of land under complex land use. Develop a process to prioritize efforts.	Prioritization of efforts and resources to get the most return.
Develop a protocol for developing land monitoring in watershed planning.	Watershed planning with respect to land is very new and will require land monitoring input.	Work with partners in one WPAC to develop the monitoring requirements for land quality outcomes and indicators in that watershed. Design and develop the data needs.	A strong process that can be adapted to individual watershed needs. Strong scientific links between land and water quality.

Recommendation	Needs and Gaps Addressed	Suggested Tasks for Process Development	Expected Benefits
		monitoring program and data management requirements. Implement a program for one land indicator, evaluate the process and improve before implementing further monitoring.	Clear expression of the link between land use and water quality and quantity. Integration of monitoring programs toward common outcomes.
Continue to create and promote the land related knowledge products developed by AENV.	Information is the greatest need for all land related initiatives. AENV has several current and potential knowledge products that are of value to partners.	Work with watershed partners to create a suite of outcomes and indicators for land quality that can be adapted. Create a portal access to the inventories of information identified by the LMT.	Knowledge products are valuable in attracting partners to AENV initiatives. AENV strengthens its role as a source of timely information.
Regulatory programs are a key deliverable of AENV but require definition of outcomes, indicators, equalization across industries, and structure to allow evaluation against management objectives.	Land quality requirements are different for different industrial land users. Behavioural change due to land management needs required by regulatory programs may not be driven to non-approved industrial sites. Third party sign off and audit programs provide a different process of assurance and need to be evaluated. Programs in place are ad hoc and have not been developed in a strong outcome and indicator framework. Point source data is not easily evaluated to determine local or regional land quality.	Validate the extent to which regulatory and non-regulatory programs are influencing best management practices. Develop tools to identify and deliver best management practices. Determine outcomes and indicators of success for contaminated site management. Develop benchmarks of equivalent capability in different landscapes to aid in evaluating the success of reclamation programs. Consider developing non-regulatory programs such as environmental plans for non-regulated industrial land users.	Identifying refinement of or expansion of programs. Single sets of guidelines, criteria and standards for soil chemical quality to be applied to all land in Alberta regardless of the temporary use it is under. Developing and monitoring outcomes and indicators will support program evaluation and improvement, and knowledge of effectiveness of policy and legislation.
Evaluate data collected by AENV against requirements for predictive and cumulative modelling, and the needs of assurance through regulatory programs. Evaluate the benefits and costs of electronic reporting or portal access to distributed databases.	Data is currently collected in paper format and stored in multiple offices. It cannot be easily amalgamated and evaluated in cumulative effects models, regional predictive models, or even regional statistics.	Evaluate existing regulatory data to determine if it can be used to identify best practices and behavioural change related to regulatory policy, legislation and guidelines. Is different data required? Evaluate current data from regulatory programs to determine the design parameters for electronic access to distributed databases, reporting formats	Knowledge of what the data can tell us and how it can be capture so that it can be modeled. The ability to evaluate data and draw conclusions on the condition and stewardship of the land, the cause and effect of pressures on the land, the extent of behavioural changes driven by regulatory programs.

Recommendation	Needs and Gaps Addressed	Suggested Tasks for Process Development	Expected Benefits
		and requirements for electronic access. Evaluate existing data for opportunities to create knowledge products, like GIS maps or release inventories.	
Pursue scientific knowledge related to condition, pressure, stewardship, cause and effect from land use, and equivalent land capability.	Knowledge is lacking for most of the province to describe current condition and cause and effect from various land uses. This information is needed for land management decisions and evaluation of constraints. Equivalent land capability is the required endpoint of reclamation but post reclamation monitoring has not been established to determine if current reclamation is successful.	Develop partnerships to deliver scientific research, such as with academic institutions. The LMT should develop the key parameters of research to advance knowledge on reclamation to equivalent land capability and on contamination mitigation and remediation. Determine the key parameters to establish evaluation of effect of land use on land quality.	The LMT would gain knowledge on the parameters it has identified as significant. Knowledge products could be developed such as trend and statistical reports, assurance to the public, and establishment of benchmarks of equivalent land capability on multiple landscapes.
Evaluate the needs of cumulative effects and other predictive modelling.	The MOSS and coal bed methane developments both require strong predictive modelling initiatives, but these are not well developed on an on-going basis.	Evaluate previously collected cumulative effects evaluations to determine if any of the data is useful in future modelling. Determine if an effective model can be developed for place based management. Determine what data is needed, in what format, collected in what method for predictive modelling. Design an electronic data capture system for future cumulative effects.	Clear knowledge of what is needed to develop strong predictive modelling tools to support MOSS, coal bed methane development, SASS, the Land Use Framework and WPACs.
Develop communication tools to make the public and partners aware of AENV land initiatives.	The mandate for land within AENV is small, and potential partners don't know what AENV is working on. The public looks to AENV for land related information, but isn't able to find it.	Promote AENV monitoring programs, output, and knowledge products. Develop a strong SOE report. Consider what teaching and educational tools could be developed around monitoring programs. Develop an advertising campaign to promote the land information portal, once it is built and inventories are in place.	AENV land monitoring is known to be a source of timely and accurate information.

8.0 CONCLUSIONS

AENV has determined that the focus of monitoring programs must change, and that land monitoring must support place based initiatives, partnership delivery, and cross-ministry initiatives. Current land monitoring programs have been developed in an ad hoc fashion, largely focused on the regulatory requirements of remediation of releases to the environment and reclamation of industrial sites. They have not been developed in the context of issue and outcome identification, but do strongly support the regulatory related outcomes. Data generated from the programs has not been centrally or electronically captured in a data base and so is not useful in its current state for predictive modelling. While the current data collection is large and widespread, it may be prohibitive to translate it into an electronic database. Data may not be compatible beyond more than the last two or three years.

Information is a key need for land managers and there is frustration by many parties at not being able to easily access or evaluate data sets. Within the SREM model, information and knowledge products are a key component of the systems approach, yet respondents are unsure of how they will fulfill those information needs from current sources.

AENV land monitoring has contributed to several well-developed information products, but they do not include a well-developed State of the Environment report for land, relating a provincial, regional and sub-regional picture of land pressures, conditions and stewardship. Outcomes for environmental management at these three levels are just now being defined. The gap that exists in current knowledge about condition, pressure and stewardship is critical for many land managers. Before any new land monitoring programs can be designed, significant front-end development work is needed to establish the outcomes that monitoring will measure.

The focus of the AENV business plan on LUFA, regulatory requirements, place- based initiatives, and support of partners offers many opportunities for the AENV LMT. It also requires significant effort focused on:

- up-front planning and identification of the pressures to, condition of, outcomes and indicators of land quality;

- development of the value proposition for partnerships – Defining what AENV can bring to the table, and where partnerships are appropriate;
- developing many processes for working as a team and with other groups;
- determining how land management behaviour and its impact to land can be captured in monitoring programs; and
- determining how land management behaviour can be influenced beyond the regulatory regime, through evaluation of regulatory outcomes.

There are so many opportunities that there is also a need to prioritize efforts. Initially, most of the effort should go toward the process development needed to support future monitoring programs. Process development should focus on:

- how to work across ministries;
- how to develop partnership related products;
- how to develop integrated outcomes and indicators for multiple media;
- how to use differently derived data sets; and
- how to support the roles AENV wants to take within land monitoring and management issues.

AENV already gathers significant data but evaluation of data is limited. Development of electronic data capture and evaluation models is key to using the data to its full potential.

A key evaluation for AENV is whether the initiatives of the business plan and the opportunities identified here to meet those initiatives, can be delivered through the land monitoring team or whether a wider land related team effort is needed. Also, promoting managerial support for the land monitoring initiatives is necessary, through presenting the value proposition related to the business plan and partnership initiatives.

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10.0 LIMITATIONS

We certify that we supervised and carried out the work as described in this report. The report is based on and limited by circumstances and conditions referred to throughout the report and on information available at the time of the site investigation. Matrix Solutions Inc. has exercised reasonable skill, care and diligence to assess the information acquired during the preparation of this report. Matrix Solutions Inc. believes this information is accurate but cannot guarantee or warrant its accuracy or completeness. Information provided by others was believed to be accurate but cannot be guaranteed.

The information presented in this report was acquired, compiled and interpreted exclusively for the purposes described in this report. Matrix Solutions Inc. does not accept any responsibility for the use of this report, in whole or in part, for any purpose other than intended or to any third party for use whatsoever.

APPENDIX A

INTERVIEWEE LIST

APPENDIX A

ALBERTA ENVIRONMENT LAND MONITORING PROGRAMS REVIEW DECEMBER 2005

PROGRAMS		INTERVIEWEES		
		Historical	Current	Future
Regulatory				
Contamination, Remediation, Reclamation	Oilsands	Terry Macyk	Clara Qualizza, Chi Chen, Veronica Chisolm, Len Leskiw	
	Soil monitoring directive, Industrial Approvals	Gordon Dinwoodie	Taras Pojasok, Bill Pelech	
	Pipelines		Don McCabe, Doug Kulba	
	Mining - coal, sand, gravel	Chris Powter, Terry Macyk	Terry Macyk, Ryan Puhlmann, Geoff Foy	
	Air deposition (oilsands, power plants)		Gordon Dinwoodie	
	Upstream Oil & Gas - Reclamation	Chris Powter	Darlene Howat, Arnold Janz, Doug Kulba,	Don Watson
	Upstream Oil & Gas - Remediation		Gordon Dinwoodie, Bill Pelech, Norm Sawatsky	
	Pulp Mills - solid waste landspreading		Gordon Dinwoodie, Terry Macyk	
	PSTs		Karen Gervais, Femke Want, Bob Lundsted	
	Spills, biocells, land treatment - oil and gas at EUB		Ken Bannister, Sue Halla, Gordon Dinwoodie, Femke Want	
	Contaminated Sites		Dave Gower	
	Pesticides		Gary Byrtus	
	Soil Metals	Gerry Lutwick	Gary Byrtus	

PROGRAMS		INTERVIEWEES		
		Historical	Current	Future
	AMD - soil sampling around solid sulphur handling facilities -	Gerry Lutwick, Gordon Dinwoodie	Chi Chen	
Approvals				
	EIAs - oil and gas, utilities	Chris Powter	Randall Barrett, Taras Pojasok	
	EIAs - NRCB (Confined Livestock)		Jim Fujikawa, Doug Beddome	
	Interprovincial and international pipelines		Pam Romanchuk	
Ambient Programs				
	Soil Acidification Program	Gerry Lutwick	Gordon Dinwoodie	
	Public Lands, land use, fragmentation, native range conservation		Gerry Ehlert	
Future Oriented Programs				
	Land Use Strategy			Neil Chymko, Avelyn Nicol
	Mineable Oilsands Strategy			Randall Barrett
	Land Planning (Southern Alberta Sustainability Strategy)			Pat Kinnear, Ian Dyson
	Watershed monitoring			Melody Brooks,
	Land Use Projections			Brad Stelfox
	Cumulative Effects Modeling			Brad Stelfox
	Riparian and Watershed planning			Heather Sinton Janet Mclean
	Biodiversity - future			Kirk Andries

APPENDIX B

SURVEY AND WORKSHOP MATERIALS AND REPORT

APPENDIX B1

SURVEY AND WORKSHOP OUTCOMES

1.0 INTRODUCTION

1.1 Survey

A copy of the survey is included in Appendix B2. The survey and invitation to the workshops were sent out to those people included in Table 1.

1.2 Workshop

The workshops were designed to present an opportunity to bring together internal and external stakeholders with an objective of visioning the future of land monitoring programs in a partnership delivery model. This included an understanding of what Alberta Environment (AENV) does in relation to land monitoring and an understanding of monitoring roles gaps and needs to develop priorities and potential partnerships. From the list of people proposed for the workshops, it was determined that two workshops would be required; one in Calgary and one in Edmonton. The list of invited attendees is included in Table 1.

The workshops began with a review of the Land Monitoring project vision, project background, introduction of the team and the assessed needs of the program by AENV.

- AENV identified that the workshops were organized to help set priorities for the limited number of programs in land monitoring. They identified that there were already focused programs and partnerships on air and water monitoring, but not for land monitoring. AENV would like to focus on clear and accepted outcomes using the Sustainable Resource and Environmental Management (SREM) model.

Matrix then presented a scope of work for the project and a summary of the interviews and survey results. In this presentation some key terms were defined; the project with relation to the SREM model was reviewed.

From the results of the interviews and survey two questions were created to help guide the workshop discussions:

- Given the needs for land monitoring identified in the survey and interviews, discuss the following in context of meeting these needs:
  - Opportunities and organizations for partnerships in land monitoring.
  - Gaps, duplication and synergies in existing programs.
  - Barriers to achieving partnerships and synergies, and possible ways to overcome these barriers.

- Given the needs for land monitoring identified in the survey and through the interviews, discuss the roles and responsibilities for AENV in land monitoring to meet these needs:

  - regulatory;
  - non-regulatory;
  - support of other jurisdiction's programs; and
  - support of large scale strategies such as integrated land management strategy, SREM, Southern Alberta Sustainability Strategy, etc.

2.0 DISCUSSIONS AND OUTCOMES

2.1 Survey

A total of 40 surveys were completed (17 from AENV, 5 from other government of Alberta Departments, 2 from Energy and Utilities Board (EUB), 2 from National Resource Conservation Board (NRCB), 2 from the Government of Canada, 4 from Business/Industry, 5 from Non-Profit Organizations and 1 from a Research Organization). The respondents had a range of familiarity with land monitoring, from direct monitoring responsibilities to no previous involvement.

The survey results indicated that there were key needs and deficiencies for the current AENV Land Monitoring Programs. One need that was identified was that although AENV land monitoring currently focuses on upholding regulatory outcomes, there is a strong need for State of the Environment (SOE) indicators, performance measures for SOE, policy effectiveness and reporting. There was also a strong sense that there was a need for cross ministry communications, with a mandate and coordinated approach to the future of land monitoring in support of land management. It was outlined that sound research and science are key needs for land monitoring. One deficiency that was determined was that outside of government jurisdictions and regulatory approval holders, the government land monitoring mandates and initiatives may not be well known.

2.2 Workshops

2.2.1 Calgary

The workshop for Calgary was conducted on Thursday, February 9, 2006. A total of 15 attendees participated in the workshop (Table 2).

2.2.1.1 *Initial Discussion*

An initial roundtable discussion took place during and after the presentations. There was a general consensus that currently there is no defining term for 'land'. It was determined that before issues of land monitoring could be addressed that an inventory of land had to be completed, on a province wide scale that would encompass all categories (agricultural, forestry, industrial). This inventory could be conducted by various partners that could be based on the ecological goods and services ratings. There was a strong focus on watershed systems which led to the possibility that land could be looked at as an interface between air and water. The municipal districts (MDs) could help define land use but were not represented at the workshops.

2.2.1.2 *Updated Workshop Question for First Break Out Group*

After the initial discussion, it was concluded that the workshop questions should be altered to address the above mentioned comments. The first revised workshop question was:

- Discuss the need for land monitoring in context of meeting the needs in:
  - State of Environment (SOE);
  - Policy; and
  - Information needs of partners.

The workshop attendees were divided into three groups which each discussed one of the three subsections of the question. The summary of the break out discussions are included below.

Group 1 – State of the Environment

The group focused its discussion around the topic of needs for "State the Environment" information and particularly attempting to address the topic from a public perspective. Three variables were considered: land condition, pressures on the land base and stewardship.

There was a general agreement that, within the context of current land condition and impact agents, AENV's mandate for contaminated sites was sound and monitoring of such sites should focus on areal extent of contamination and on any trends in contamination of the land base. Land conversion, i.e. changing uses that sometimes occur in an "evolutionary" manner, was deemed to be a very important topic for AENV's attention. The conversion process has attendant impacts on land uses and capabilities, e.g. for agriculture, water, recreation. The AENV Land Management group should engage others within and outside of government to bring the land condition and management component into the larger discussions on state of the Alberta environment. There is an expectation that AENV would provide long-term land - based information for the decision-making process.

The notes that were captured on the flipcharts are listed below:

- Public perspective.
- Condition of the environment, change of the capability and condition of land:
  - Direction, duration, reversibility, rate.
- Pressures on land classification changes:
  - Natural, agricultural, rural, residential, urban, pavement.
- Functions of land that may be changed:
  - water (quality/quantity);
  - agriculture;
  - recreation (public access); and
  - wildlife habitat.

- Stewardship and responsibilities:
  - conversion management and optimization;
  - public influence;
  - exercise stewardship responsibilities at a corporate level, not at a personal level; and
  - implement policies.
- AENV expected to provide accurate long term data in usable and accessible form.

Group 2 - Policy

Policy is required prior to setting legislation under which guidelines and standards can then be developed. The focus of the discussion was to determine what AENV policy needs are in land monitoring that would enable them to make better legislation, guidelines and standards. It was identified that AENV has developed site specific guidelines and standards for soil and that the Canadian Council of Ministers of the Environment (CCME) has provided standards that are protective of human health for many parameters; however, there is a need for policy that will address cumulative impacts for areas such as oil sands development areas.

Prior to setting policy that will reflect place based needs, it was noted that AENV needs to identify indicators of risk. Baseline data is required for these indicators and the data is often not readily available or hasn't been collected. It was also identified that policy affects three levels of government (provincial, regional and sub-regional) and that much of the implementation of policy is at the municipal district level and they should be included in the development of policy.

Flip chart notes included:

- Need site-specific information (site and place), reporting needed on summary statistics.
- Cumulative Impacts Policies needed to:
  - Set outcomes.
  - Determine placed based areas and associated monitoring needs (oil sands, may need new process for some areas).
  - Set acceptable levels of risk with respect to land use intentions, to minimize human health and environmental issues.
  - Will AENV be accountable for this?
  - What does AENV currently look at as far as indicators (Ecological/environmental, functioning ecosystem, equivalent land use)?
  - How would the quality of land be assessed?
  - What is the current land use of specific areas/province?
- The possible indicators of risk (need to determine these to set monitoring policy):
  - , point source or ambient;
  - soil chemistry, biodiversity;
  - groundwater sensitivity; and
  - reclamation success? Recreate biology?

- A policy would require standards and baseline data (known releases, number of contaminated sites, reclamation success over time).

- Right now there is no continuous set of data so is AENV meeting its targets or outcomes?

- This information has to be scientifically based.

- Discussed policy versus procedure:

  - policy is limiting land use decisions;
  - reclamation standards may need to have a broader view; and
  - should there be future monitoring after reclamation certification to ensure outcomes are being met.

- Policy is at a three level system (provincial, regional, sub-regional):

  - cities and policies;
  - quality of land dependant on social implications (build up instead of out mentality); and
  - zoning land capability roles fall to MD.

- Who retains liability management?

  - land use for future;
  - top level land use decisions;
  - what kind of monitoring takes place; and
  - land change/footprint.

Group 3 - Information Needs of Partners

The group included representatives from the EUB, the Oldman Watershed Advisory Committee and the PFRA. The discussion began with a listing of possible partners for AENV in land monitoring:

- The Energy and Utilities Board.
- The Prairie Farm Rehabilitation Agency.
- Sustainable Resource Development.
- Watershed advisory volunteer groups.
- Non-government organizations.
- The public in general.
- Landowners.
- Industry and the Federal government.

It was agreed that partnership groups up would be interested in land use from a different perspective including:

- economic use;
- societal use;
- recreational use;

- ecological value; and
- tourism.

The key motivators for partners to enter into partnerships were itemized as:

- information needs;
- funding;
- regulatory requirements;
- efficiency/effectiveness/reducing overlap and contradiction;
- communication;
- streamlined delivery of programs;
- feedback to the policy development loop and ability to influence policy;
- creating synergy of available resources; and
- designing and using best practices.

Information needs were identified as the primary motivator of partnerships in land monitoring and information needs were identified as:

- access to and knowledge of information sources;
- cumulative knowledge across regions or jurisdictions;
- benchmarks of condition of the land;
- historical quality information;
- the level of partnership requires different levels of information; and
- indicators.

  - Depend on the perspective of the partner.

Bridging gaps in data and risks of data sets from multiple origins was discussed:

- data requirements tend to drive collection but may not support other users;
- quality of data; and
- interpretation or misinterpretation of context in which data was gathered.

The group identified the need to set a framework for land that looks at:

- goals for land;
- indicators of the goal; and
- cause and effect of different land uses.

Only then can monitoring data be effective in informing land decisions.

2.2.1.3 *Updated Question for the Afternoon Breakout Session*

For the afternoon break out discussions, the workshop question was changed to the following:

- What are the roles and responsibilities of AENV in Land Monitoring in the context of the following:

  - State of the Environment;

- Policy; and
- Partnerships.

Group 1 – State of the Environment

The group set out to address the question of how AENV could take a leadership role and concluded that the starting point was its regulatory mandate and the responsibilities emanating from it. All agreed; however, that this would be rather limiting in both scope and aerial extent, suggesting that AENV should venture to a more regional approach and expand its activities in land monitoring. A key would be making the linkage between land quality and land use and water quality and quantity. The process of moving toward a more regional scale would start by confirming functions (uses) of interest, then defining the linkages and interactions among them. It would be AENV's role to add value by representing the important role of land in the environment and by providing information that would contribute to problem solving and decision making.

The notes captured on the flipcharts are outlined below:

- regulatory responsibility;
- focus on watersheds;
- should AENV lead?
- direction from site-specific environmental approvals to regional land use scale (conversion scale);
- confirm functions of interest (uses); and
- linkages of functions to land uses.

Group 2 - Policy

The topic of discussion was the roles and responsibilities of AENV in land monitoring in the context of setting policies, standards and guidelines. The discussion centred on determining why monitoring is needed (the desired outcomes) and what should be monitored to achieve the needs identified (performance measures).

The perceived public desire is to have clean air, clean water for drinking and recreation and clean land for recreation, food and industry. In addition, the public does not want to retain liability from industry for future generations. There was discussion on what land monitoring and reporting needs are required to meet these desired outcomes and what is AENV's role in monitoring and reporting with respect to land. AENV's role in collecting and coordinating the data was also discussed. There was no perceived consensus on these discussion points. It was suggested that AENV should be inclusive of green zone and AAFRD land when setting policy. The participants had diverse backgrounds and points of view which may have contributed to the lack of consensus.

The notes that were captured on the flipcharts are outlined below:

- AENV to coordinate data, define standards, policies and guidelines and determine if effective.

- AENV to identify areas with gaps in land monitoring, determine why monitoring data is needed.

- SOE reporting important, public need and want to know:

  - land, air water quality (recreation, food, industry);
  - must report on ecological function of land (link to policy);
  - have site specific data on land use change; and
  - could only be done efficiently through partnerships.

Group 3 - Partnerships

The same group convened to discuss roles and responsibilities of that AENV can assume within partnerships for land monitoring. Since information needs were seen as the primary need that motivates partnerships, the role of information coordination was identified. AENV could create inventories of:

- data sets;
- partnerships;
- land monitoring and land management initiatives;
- land related strategies;
- other land related jurisdictions and roles; and
- monitoring needs of:

  - partnerships; and
  - different land uses.

AENV could also lead in developing knowledge products such as:

- Watershed boundaries;
- Regulatory information; and
- Identifying land indicators for all players or specialized requirements.

A strong communication role was identified.

The group indicated that AENV should lead the development of a "strawdog" of land issues and required monitoring program and take that to partnerships. AENV could become the facilitator in a number of initiatives related to land monitoring without doing the monitoring work themselves.

The group also indicated that there are too many initiatives on the go right now, related to consulting stakeholders. AENV should streamline the process, perhaps amongst the six monitoring teams as well as when the cross ministry initiative starts.

2.2.1.4 *Calgary Workshop Summary*

There were no clear and definitive answers established during this workshop. Many ideas were presented and there was a very proactive attitude when it came to trying to establish outcomes for the land monitoring programs at AENV. Some key points that were identified for the future direction of Land Monitoring are listed below:

- more interaction with other departments (such as SRD);
- initiative must be taken beyond the regulatory framework;
- land monitoring must move towards a regional aspect rather than site specific programs;
- land monitoring programs must move toward efficiency and effectiveness;
- move towards more accurate SOE reporting and stewardship;
- monitoring must support decisions and policy, not just generate data;
- AENV must be realistic (think big picture, realistic goals, accept progress); and
- must define what land is before one can determine outcomes.

2.2.2 Edmonton

The workshop for Edmonton was conducted on Friday, February 10, 2006. A total of 19 attendees participated in the workshop (Table 3).

2.2.2.1 *Initial Discussion*

This group had many more government representatives. It was identified during the morning presentations that a cross ministry initiative is needed to create a fully functional land monitoring program. This program will require a land monitoring manager which could be AENV. If there was in fact a managerial role, basic information on land monitoring would have to be outlined and identified. It was identified that there currently is a lack of data at the regional levels and limited government budgets, yet the SREM model will still have to be followed at all levels. As with the Calgary workshop, it was identified that there is a need to integrate land monitoring with air and water.

2.2.2.2 *Morning Workshop Breakout Session*

The Edmonton workshop used the original questions that were outlined in the workshop invitation for the workshop breakout groups. The first question was as follows:

Given the needs for land monitoring identified in the survey and interviews, discuss the following in context of meeting these needs:

- opportunities and organizations for partnerships in land monitoring;
- gaps, duplications and synergies in existing programs; and
- barriers to achieving partnerships and synergies and possible ways to overcome these barriers.

Group 1

Opportunities and organizations for partnerships as well as barriers to successful partnerships in land monitoring were discussed. A number of factors for successful partnerships were identified including:

- they can't be legislated;
- they need to develop to meet a common need;
- a general umbrella scope should be provided;
- partners need to be involved from the beginning and they should be involved in the design of the program;
- standards need to be set for the program so that partners from different areas can compare results;
- small local groups should take the lead rather than a regional approach;
- a top-down dictatorial approach is a barrier to success;
- need to provide leeway and enticement to work;
- need a centralized data collection system that each of the regions feed into;
- need assurance that data won't be used against them;
- give credit for the monitoring activity; and
- need support such as science or decision based support.

Specific factors contributing to the success of the Forest Management Association (FMA) partnerships were identified; the partnership was driven by improved efficiencies, it met due diligence requirements and there was an opportunity to obtain credit elsewhere. It was also identified that there is a need to include municipalities before going too far down the SREM road. There was discussion about conflict. It was identified that conflict will occur; therefore, there is a need to plan for conflict and the process for resolving it before it occurs.

Notes captured on the flipcharts were as follows:

Partnerships

- Cannot be legislated, meet a common need.
- Driven for efficiencies, due diligence and data can obtain credit elsewhere.
- Leverage funding, cost effective.
- The onus on user to be compatible with other users.
- Must obtain similar standards across industries.
- Municipalities have mandate from province on land, no backstop.
- SREM and data must belong to everybody, must integrate policy/outcomes and information.
- Develop a process for management purposes.
- Partnerships would work better with small local groups not through AENV, who need leeway and an enticement to work.
- Need a centralized data collection system that each of the regions feed into (portal).
- Don't confuse governance with initiatives at grass roots level.
- Partners need a broad direction and scope, need to be sure that data will not be used against them (positive spin, credits for data?).
- Population growth and economic growth are driving substantial change in land use.
- Include partners in process from beginning.

Gaps and Duplications

- Many duplications in data currently.
- Is current monitoring taking us where we want to go?
- Conflict will occur between partners etc., must have contingency plan for conflict.

Grass roots must be included in design.

Barriers

- Use top down method? Too dictatorial, no opportunity to evolve, need support through science.

- Need to include MDs before we get to far along the SREM process.

Group 2

The group included an independent consultant, a representative of Sustainable Resource Development and a representative of Agriculture Canada.

Opportunities

The discussion of opportunities included developing partnerships with:

- other Alberta government departments;
- other levels of government; and
- industry.

The idea of partnerships required identifying what the value of monitoring would be to the other partner.

The State of the Environment report was also seen as an opportunity to create information needed by many and to communicate externally.

Gaps

Gaps in land monitoring included:

- A lack of provincial and regional scale information.
- All land managers need to be at the table, not just AENV.
- State of the environment is a key area of public interest, but not given the needed weight within AENV and other government departments, which results in lack of support from other ministries and lack of public confidence in the report.
- Relationships with other ministries are strained, limiting AENV effectiveness in some instances.
- Regulatory mandate is not always evenly managed:
  - reclamation quality is still a concern;
  - work with other departments is needed;

- linear developments in the green zone need cooperation from SRD; and
- dialogue on metrics of reclamation is needed.

Barriers

The barriers identified to fulfilling the needs of land monitoring included:

- Lack of a strong land mandate for AENV, making it difficult to lead partners.
- Relationships with other land management groups, particularly SRD:
  - other than in regulatory criteria and guidelines, SRD does not look to AENV for input to land related monitoring or decisions.
- Defining the value proposition for partners – why should they report their data to AENV? What is in it for them?

A place or champion for reporting state of the environment type indicators that is linked to major initiatives such as the land use strategy or land conflict resolution.

Group 3

The topic of discussion for this session was partnerships. The group began by listing a number of potential partners both within and outside of government. These included: Alberta Agriculture and Ducks Unlimited. To develop successful partnerships, it was acknowledged that there must be some benefit to both parties. Several potential barriers were identified including: lack of resources, possible partner reluctance to cooperate with a regulator and stakeholder fatigue. The group generally agreed that, although building partnerships would be a challenging task, it was essential to achieve future success in AENV's responsibilities related to land management in the province.

Notes captured on the flipcharts are outlined below:

Partnerships

- SRD and AENV should work together;
- may need third party certifiers; and
- would need to work with municipalities and associations.

Gaps

- Some gaps would include absence of important players, absence of regional umbrella management bodies, no validation of feedback loop.
- Some synergies include shared responsibility on specific land base, education on ecosystem approach rather than compartmentalization and relationship building.

Barriers

- Non public data that could negatively reflect on process.
- Is SREM model valid; is there a defined long-term operational commitment?
- Budget and resources.
- Reluctance of some organizations to participate in regulatory area.
- commitments to international trade agreements and markets.
- Silos and territoriality.
- Varying capacities to participate effectively.
- Inflexibility and preconceptions.

2.2.2.3 *Afternoon Breakout Sessions*

The second question was as follows:

Given the needs for land monitoring identified in the survey and through the interviews, what are the roles and responsibilities for AENV in land monitoring to meet these needs?

- Regulatory.
- Non-Regulatory.
- Support of other jurisdiction's programs.
- Support of large scale strategies such as integrated land management strategy, SREM, Southern Alberta Sustainability Strategy, etc.

Some of the workshop attendees left after lunch, so the second question was discussed with the entire group instead of utilizing breakout groups. The discussion covered the first two points of the question then steered away from the question and concentrated on SOE reporting.

Group Discussion

The notes captured form the flipchart are listed below:

Regulatory

- Continuing requirement.
- Direct and indirect application.
- Monitoring should feed the regulatory needs but be value neutral itself.

Non Regulatory

- Evaluate Water for Life consultations with the public to see what if any land information there may be.
- Are land use impacts to water being monitored?
- Support policy decisions.
- Trends reporting/SOE.
- Fill gaps that may arise in SOE reporting.
- Need policy/planning mechanisms for AENV to support local or regional groups or partnerships.

SOE Reporting

- Little specificity re content.
- Is the SOE too political?
- What is the actual purpose and application?
- Are there implications for government departments?
- Need education and information.
- AENV could lead the broadening of scope of SOE across departments.
- Most effective leverage is from the public:

  - they feel that AENV is not knowledgeable about the SOE;
  - public expectation that AENV will identify the thresholds; and
  - public interested in cumulative effects.

- Ministerial accountability for SOE, but land management decisions not AENV, how do we foster positive relationships?
- Needs ministerial level support.
- What do we hope to achieve?

  - Status quo, expansion, new direction.

- AENV should inventory Alberta government monitoring.
- SOE reporting not very good and there is improvement necessary for credibility, public relation issues of smoothing information, removing indicators.
- Can SOE be completed using a cross-ministry team, could it contribute to change?
- AENV roles:

  - detective;
  - librarian (Quality Assurance/Quality Control (QA/QC));
  - public servant;
  - assurance role through policies, regulations, objectives; and
  - contribution to decision making.

- How can SOE serve its purpose as a technical document?
- Link land monitoring to water and air monitoring.
- Need cross ministry cooperation for indicators of all land, new group required?
- AENV could either report other ministries work or fill gaps identified.
- AENV as a facilitator.

2.2.2.4 *Edmonton Workshop Summary*

Because a large proportion of workshop attendees were government personnel from ministries including AENV, SRD and Agriculture, much of the discussion related to intragovernmental considerations. As in Calgary, the breakout sessions provided a wide range of opinions and suggestions; however, the limited time made it difficult to reach any real consensus. Rather, the results comprised a collection of points representing the varying perspectives of the participants. This is reasonable as the workshop was not designed as a consensus – seeking event. Among the more consistent themes apparent during the discussions were the following:

- The regulatory monitoring programs will continue to provide important information and should have both direct and indirect application.

- The non-regulatory monitoring activities must provide information to support policy decisions, facilitate environmental trend reporting and contribute to SOE reporting. An effective and comprehensive SOE reporting process requires commitment from senior levels – political will – and it was suggested that such a will was not yet entrenched because "information can be dangerous."

- The most effective leverage for future AENV programs is likely to come from public opinion and expectations. Therefore, public information and education are essential tools in the AENV toolkit.

The general mood seemed to be that continued and expanded land monitoring was a desirable goal; however, because land quality is not a top of the mind issue, success will be achieved only by linking land monitoring results as a value added contribution to other more prominent initiatives such as water quality and quantity.

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Survey Results (Included Responses)

AENV Land Monitoring Needs Review Pre-Workshop Survey

Report created on: Tuesday, February 07, 2006 10:50:00 AM

The results of your survey are displayed below. If your survey includes text responses, click the "View" button to read individual results. To exclude a particular response, click the Included Responses button. You can then view the set of individual responses that are currently included and select those you wish to exclude. Results below contain only Included responses

EXCLUDE BLANK RESPONSES

Launch Date	01/31/2006 - 4:20 PM
Modified Date	02/01/2006 - 9:40 AM
Close Date	02/07/2006 - 10:40 AM
Email Invites	0
Visits	73
Partials	0
Completes	40

Go to Individual Complete Responses:

Show respondent's emails

INCLUDED RESPONSES

EXCLUDED RESPONSES

Included Respondents: 40
Excluded Respondents: 0

Cross Tabulate
Cross reference multiple questions

Download Results
Receive results in spreadsheet format

Responses: (•) Completes only ( ) Partials only ( ) Completes & Partials

1. Please specify which membership category best describes the Sector you represent?	Number of Responses	Response Ratio
Academia	0	0%
Business/Industry	4	10%
Non-Profit Society	5	13%
Government-Federal	2	5%
Government-Municipal	0	0%
AENV	17	44%
AAFRD	1	3%
Sustainable Resource Development	3	8%
Community Development	1	3%
Energy	0	0%
Municipal Affairs	0	0%
VIEW Other, Please Specify	6	15%
Total	39	100%

2. Please state your involvement with the AENV Land Monitoring Program (please choose only the one that best applies).

	Number of Responses	Response Ratio
Employed with AENV in Land Monitoring	3	8%
Employed with AENV in another capacity	11	28%
Partner with AENV LM—Committee member, Project Team member, etc.	2	5%
Share/supply data as a regulatory requirement	1	3%
Contribute (i.e. research) to policy development as related to Land Monitoring.	9	23%
Other, Please Specify	13	33%
Total	39	100%

Question 3 applies only to non-AENV organizations.

Questions 4 - 10 apply to all respondents.

3. Does your organization currently have land monitoring programs?

	Number of Responses	Response Ratio
Yes	18	82%
No	4	18%
Total	22	100%

17 Responses

4. What information or services does your organization require most from AENV's Land Monitoring program? Please specify (consider both short-term and long-term needs).

35 Responses

5. In your work, have you identified any gaps in Land Monitoring as it applies to AENV's mandate? (information deficiencies, regulatory gaps, areas where funding is required but not available).

	Number of Responses	Response Ratio
Yes	24	73%
No	9	27%
Total	33	100%

30 Responses

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Go to Individual Complete Responses:

Show respondent's emails.

INCLUDED RESPONSES

EXCLUDED RESPONSES

Included Respondents: 40
Excluded Respondents: 0

- Cross Tabulate
  Cross reference multiple questions
- Download Results
  Receive results in spreadsheet format

Responses: (•) Completes only ( ) Partials only ( ) Completes & Partials

1. Please specify which membership category best describes the Sector you represent?	Number of Responses	Response Ratio
Academia	0	0%
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Government-Municipal	0	0%
AENV	17	44%
AAFRD	1	3%
Sustainable Resource Development	3	8%
Community Development	1	3%
Energy	0	0%
Municipal Affairs	0	0%
VIEW Other, Please Specify	6	15%
Total	39	100%

2. Please state your involvement with the AENV Land Monitoring Program (please choose only the one that best applies).

	Number of Responses	Response Ratio
Employed with AENV in Land Monitoring	3	8%
Employed with AENV in another capacity	11	28%
Partner with AENV LM—Committee member, Project Team member, etc.	2	5%
Share/supply data as a regulatory requirement	1	3%
Contribute (i.e. research) to policy development as related to Land Monitoring.	9	23%
Other, Please Specify	13	33%
Total	39	100%

Question 3 applies only to non-AENV organizations.

Questions 4 - 10 apply to all respondents.

3. Does your organization currently have land monitoring programs?

	Number of Responses	Response Ratio
Yes	18	82%
No	4	18%
Total	22	100%

VIEW 17 Responses

4. What information or services does your organization require most from AENV's Land Monitoring program? Please specify (consider both short-term and long-term needs).

VIEW 35 Responses

5. In your work, have you identified any gaps in Land Monitoring as it applies to AENV's mandate? (information deficiencies, regulatory gaps, areas where funding is required but not available).

	Number of Responses	Response Ratio
Yes	24	73%
No	9	27%
Total	33	100%

VIEW 30 Responses

6. In your work, have you identified any duplications in Land Monitoring as it applies to AENV's mandate?

	Number of Responses	Response Ratio
Yes	5	15%
No	28	85%
Total	33	100%

9 Responses

7. Which of the following do you feel is the **most** important outcome for AENV's Land Monitoring Program?

	Number of Responses	Response Ratio
Land monitoring programs assure that AENV is able to measure performance in achieving defined outcomes for environmental management.	19	51%
Land monitoring programs assure that AENV's regulatory responsibilities are met.	1	3%
Land monitoring provides accurate and timely information to support SREM, our partners' decision-making is guided by quality land monitoring information.	17	46%
Total	37	100%

8. In your opinion, are there any other *broad land monitoring* outcomes or themes that AENV should include? Would you recommend any changes or edits to the above outcomes?

24 Responses

9. What, if any, are the barriers to AENV land monitoring programs supporting the achievement of these outcomes. Please rate the level of your priority

The top percentage indicates total respondent ratio, the bottom number represents actual number of respondents selecting the option	1 High Barrier	2 Moderate Barrier	3 Low Barrier
1. Loss of people and expertise (corporate memory).	34% 12	51% 18	14% 5
2. Lack of a central repository for collected data and systematic analysis of data.	68% 23	26% 9	6% 2
3. Lack of communication between departments.	62% 21	29% 10	9% 3
4. Lack of financial resources.	35% 12	62% 21	3% 1
5. Need for more partnership involvement.	29% 10	60% 21	11% 4
6. Need for a different focus for Land Monitoring at AENV.	16% 5	42% 13	42% 13
7. Need to establish acceptable standards, guidelines and thresholds for monitoring parameters.	42% 14	42% 14	15% 5

8. Mandate for land management involves many government agencies.	61% 20	27% 9	12% 4

10. Please provide any other comments or suggestions to help shape the future directions of the planning process.

18 Responses

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Each individual respondent is referenced under the # column.

1. Please specify which membership category best describes the Sector you represent?

#	Response
1	Natural Resources Conservation Board
2	EUB
3	We are a research organization, bias balanced.
4	EUB
5	Alberta RiverWatch is a non-profit company
6	Natural Resources Conservation Board

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2. Please state your involvement with the AENV Land Monitoring Program (please choose only the one that best applies).

#	Response
1	Ex AENV employee in land reclamation/enforcement
2	No involvement
3	Chair ERWP
4	Consumer of info for reporting purposes
5	EUB - waste management and related soil monitoring
6	Bow River Balsam Poplar Restoration Project
7	not sure
8	provide support on request
9	Previously contributed to policy development
10	No previous involvement
11	Uncertain specific activities LM. Data and policy?
12	To date, have not had a lot of involvement
13	minimize industry disturb. in AB. protected areas

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Each individual respondent is referenced under the # column.

Question 3 applies only to non-AENV organizations.

Questions 4 - 10 apply to all respondents.

3. Does your organization currently have land monitoring programs?

#	Response
1	Registration/Approval requirements for confined feeding operations. Inspections to confirm compliance with approvals/legislation
2	Soil and water monitoring programs. Stats branch monitors land use, values, etc.
3	Spill reporting, collection of geological data, collection of other monitoring reports such as waste disposition reports.
4	Post Reclamation Monitoring Forest monitoring
5	Create fencing projects to move cattle to off-stream watering
6	We have createda aLocal Level Indicator program that utilizes existing data and we report on the staus on a regualr basis. Our first report come out March of 2003 and our second is scheduled for March or 2007.
7	Condition of approval for oilfield waste management facilities.
8	Agriculture and Agri-Food Canada has four soil quality benchmark sites in Alberta.
9	Bow River Balsam Poplar Restoration Project
10	Working with SRD, AB Ag and AB Env on ground and surface water vulnerability.
11	we try to visit all our sites in reclamation status each year
12	Administering regulations re. land application of animal manure based on nitrogen and salt loading to the receiving soil.
13	Groundwater monitoring for EUB - SAGD water disposal. Surface Water, Wetland, Wildlife monitoring as EPEA Approval - SAGD Project.
14	Monitoring for reclamation,operating adherance and enforcement of the Public Lands Act.
15	Monitoring Soil and Vegetation plots for CEMA (this may be listed by others) Monitoring soil and vegetation plots for Cardinal River Coal.(Also may be already listed).
16	Hundreds of individual reclaimed sites over short to medium term; truncated. Some local environmental conditions during active life of an operation.
17	ANHIC data information - rare species element occurances mapped

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Each individual respondent is referenced under the # column.

4. What information or services does your organization require most from AENV's Land Monitoring program? Please specify (consider both short-term and long-term needs).

#	Response
1	Candy!
2	Not aware of any requirements at the present time. Apparantly better awareness of the program and its impact on us is needed
3	Chenges in soil as they relate to air emissions and vegetation health.
4	Can't think of anything right now.
5	Access to information from contaminated sites, shared information about and for oil industry development.
6	State of the environment reporting and appropriate monitoring programs related to, i.e. oil and gas, coal mines, etc.
7	In addition to the performance measures for upstream oil and gas wellsite reclamation that are posted on the website, pipeline disturbance, spills and releases statistics should be available along with statistics on the reclamation of other types of industrial sites such as sand and gravel pits, plant sites, etc.
8	Information with regards to the success of past policies. How are we doing at meeting objectives.
9	What do you do and why? How is that related to integrating with water management plans?
10	We require info on grourid cover, land uses and terrestrial ecosystems and their distribution.
11	Data access
12	specific environmental indicators (quantifiable) periodic reporting on the status of those indicators
13	Indicator parameters and soil quality guidelines to appropriately assess impact of operations to prevent restriction of land use, current and future.
14	We have a viable monitoring program in which to be able to know if we are meeting our outcomes. Interface between land monitoring and air or water monitoring.
15	Interest in Protocols
16	Aerial photos, habitat restoration expertise, volunteer training, ABENV contacts and funding assistance would be of great value.
17	Concerned with land change issues as related to climate change adaptation. How are ecosystems changing over the long term. How are land use practicies changing? Can these changes be linked to a changing climate.
18	Supporting and guiding information for reclamation criteria development and update.
19	Not sure
20	Information on waste management facilities - type of facility, location, approval information, status

21	Contamination levels, reclamation status and land use on regional basis.
22	I am somewhat unaware of AENV's Land monitoring program and would like to know more about it before commenting.
23	Improved "across-ministries" consistency in land monitoring program standards/criteria.
24	Soil Chemistry Quality (related to changes due to deposition from air); Spatial distribution of soil types for EIA and Airshed Management; Soil Quality on reclaimed land scapes; Landscape stability for reclaimed features; biodiversity-productivity of natural and reclaimed landscapes for SOE and Land Management
25	Performance measures for sustainability that apply before decisions are made.
26	Can't answer, don't know what all AENV land monitoring programs currently provide.
27	Reclamation Criteria/ Process- audit
28	soil quality, vegetation relationships, land capability, success of various soil reclamation prescriptions,yield, diversity, planting or LFH transplant techniques, fertilizer recommendations, etc.
29	Identification of REAL land issues vs theoretical or imagined ones.
30	How AENV's land monitoring reflects and advances the department's direction under SREM - the strategic systems approach as supported by the five shifts
31	data for long-term trends and analysis
32	Data storage and aggregation capacity for regulatory monitoring data, GIS, data and information to support evaluation and reporting.
33	cumulative effects of oil and gas activity
34	I'm not sure what the Land Monitoring Program does.
35	cumulative effects, big picture, buffering of adjacent public/private lands & corridor protection to avoid sterile islands of protected areas.

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5. In your work, have you identified any gaps in Land Monitoring as it applies to AENV's mandate? (information deficiencies, regulatory gaps, areas where funding is required but not available).

#	Response
1	Not Enough Candy!
2	No comments at this time
3	My answer should be 'don't know' as I am not familiar with all Land Monitoring programs.
4	Not sure what AENV's mandate is with respect to land monitoring.
5	standardised biomonitoring protocols
6	Provincially, for each industry and cumulatively, the area of disturbance requiring reclamation should be pubicly available. However, The EUB doesn't have good data on the number or total kms of abandoned pipelines. Also, sand and gravel pits less than 5 ha are not included in the CoP for Pits. So it is difficult to determine the area of disturbance requiring reclamation.
7	reclamation research and monitoring
8	Don't know yet, but it looks like many areas of everlap and turf-protection.
9	cummulative effects cross ministry coordination
10	A fair amount of work is in progress to review critiera, develop subsoil critiera, and to review regulatory jurisdiction.
11	There is no comprensive program. Air and water monitoring requirements to support land monitoring is not well documented.
12	Funding for ngo's is not easily accessible.
13	We need scientific information which provides a solid foundation for our rec criteria. I do not know if funding is available.
14	Not sure
15	Not all waste management facilities are listed in EMS, PST sites generally do not have an accurate location,
16	QA/QC would like to see audit both paper and intrusive on site for contaminated sites. Monitoring of reclamation success in the insitu oil sands sector to develop sector specific criteria for reclamation. Develop and initiate a performance measure for approved facilities for contamination and reclamation progress. Transferal of soil survey data in EIA's to a province wide soil survey information data base (ie. Agrasid)
17	Communication abot what it is, and what AENV's mandate is related to it.
18	See (4) above. Additional soil quality criteria (i.e. "rooting-zone, below "rooting zone"): plant macronutrients e.g. nitrogen, potassium, phosphorus

19	Ongoing and coordinated terrestial based monitoring similiar to airshed and watershed monitoring is needed in areas of large land distrurbance (Athabasca Oil Sands)
20	1. AENV does not adequately understand the effects of land management on the flow and quality of water and the aquatic/riparian environment. In terms of flow, the key issues are the increase in high flows and the decline in base (low) flows. 2. To the extent that the effects on water flow and quality and the aquatic/riparian environment are understood, AENV does not adequately incorporate this knowledge into its management system so that its decisions are sustainable. 3. AENV does not monitor its own decisions to ensure that they are sustainable and make this information available to the public.
21	Periodic "State of Environment" reporting across several media (air, land, water) by region.
22	Certification processing through audit is deficient relative to effectively protecting the land resources (soils)without bias (third party review/inspection).
23	AENV has a lack of calibration data relating soils (natural and reclaimed) to vegetation performance (productivity, composition, diversity, etc.). AENV inspectors are often critical of what industry/consultants do but they do not have their own information to back-up their claims or concerns and they do not accept what is given to them. Wellsites in the green zone have little/no soils requirement, yet they are a major land disturbance. There is little known about natural soils in the green zone, sustainability of forest harvesting, for instance, the sustainability of harvesting jack pine stands. This may be SRD's responsibility but they do not have this information either.
24	LM as it might feed the debate about real vs land issues
25	The scope of the program and how it integrates the needs of others within and outside GOA
26	data gaps
27	Utilization of monitoring information requested of approval holders is not utilized in a comprehensive manner
28	Not sure whether this is your mandate or not but, as always, more detailed, free data is required.
29	money for monitoring of post reclamation sites
30	in my opinion, big gaps in the minds of politicians to demand/in top burecrat decisions to support & continue to sell/ & industry to demand & participate in degradation of unique protected area (i.e. Rumsey) by not having either: buying-out mineral interest/discouraging ongoing additional sales (& having recognized coalbed methane as conventional gas)/not demonstrating leadership by foregoing exisitng mineral agreements.

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Each individual respondent is referenced under the # column.

6. In your work, have you identified any duplications in Land Monitoring as it applies to AENV's mandate?

#	Response
1	- no comments at this time
2	Again, not sure of the AENV mandate so can't identify duplications.
3	Two "teams" appear to be working toward similar goals. The people involved with the land monitoring workshop and the AENV sponsored "Cross Ministry Monitoring Team" chaired by Tom Dickson.
4	Water plans are done on watersheds yet AENV, SRD, DFO, municipalities, etc. all act in their own stovepipes.
5	Lots of initiatives/individual projects looking at this issue, no consistent provincial process
6	Perhaps overlap is more applicable than duplication, but from a regulatory perspective there needs to be equivalency.
7	The City of Calgary Natural Areas, Environment Canada and RiverWatch carry out projects without involvement from ABENV.
8	Assumes I know what AENV's mandate is.
9	Waterbody/watercourse monitoring has numerous agencies involved making it difficult to coordinate. A waterbody may involve AENV (water mgt.) Public Lands(bed and shore),DFO(habitat), Fish and Wildlife (fisheries resource) etc.

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Each individual respondent is referenced under the # column.

8. In your opinion, are there any other *broad land monitoring* outcomes or themes that AENV should include? Would you recommend any changes or edits to the above outcomes?

#	Response
1	Supply everyone with Candy.
2	no comments at this time
3	- demonstration that monitoring is efficient and effective, - credible monitoring information that is accessable to all albertans, - appropriate funding is available to initiate, develop and implement any monitoring programs, - decision making is pressed down to the lowest level possible.
4	The loss of good quality agricultural land due to urban sprawl and industrial development should be made available. This information will support the land strategy, so that Class 1 & 2 agricultural land remains agricultural.
5	Third outcome is good but could talk a little about measuring performance.
6	None of the above are MOST important - the most important is breaking down the stovepipes for the benefit of watersheds and their source protection
7	The link between land monitoring and watershed management needs to be clearly defined and strengthened.
8	Not at this point.
9	N/A
10	Land monitoring provides the basis for operational and funding partnerships with local ngo's involved with habitat restoration.
11	Change the first one to read Alberta Government instead of AENV. Need to have land monitoring programs integrated across departments to support SREM
12	Monitoring for its own sake is of limited value, and should be done in conjunction with and in support of identified AENV (or other) initiatives, towards accepted goals (e.g., provincial land use strategies).
13	I think AENV is in a perfect position currently to become the "mother ship" of land stewardship and guiding land managment in this province if partnering with stakeholders is achieved, common goals are agreed and set.
14	"stewardship" of the soil/land resource
15	Land monitoring related to tracking natural variabilty of soil distribution and quality - outcome that land in non-developed will be managed to maintain natural variability. Specific measurable terrestial bench-marks related land productivity for wildlife, forestry, and watershed values for land-based monitoring
16	1. Decisions by AENV and others must be sustainable. 2. AENV and others must be accountable for their decisions by knowing in advance that their decisions are sustainable.

17	This survey ought to be elevated above an indivdual department. ASRD, ACD, Energy all have land related objectives that either impact or are related to "outcomes for environmental management". Confining the scope to just that of AENV limits the ability to identify cross-departmental gaps, overlaps, inefficiencies, etc.
18	Monitoring cumulative effects of integrated land use to aid in decision making. We talk about environmental management yet we continue allow cumulative activities to persist unchecked.
19	In the past, not evident that information from monitoring actually was used in developing better management practices. For instance, on wellsites, there is much concern about tightening the criteria, but there is very little historical information (that is verifiable, transparent, etc. often seems to be opinion based not factual)on what the problems are.
20	I'm having some difficulty with the language we use and the assumptions we made when each of uses words such as "outcomes" - I see the outcomes in #7 above as "outputs" that lead to acheiving environmental outcomes. So what the program needs to guide it is agreement on what the environmental outcomes are with integration of economic, social and political factors. It may be helpful to consider a Logic Model approach to the design of this program. Under this model your inputs (resources, staff) lead to outputs (information, reports) that lead to outcomes (awareness, behavioural change, and finally the quality of the environment - e.g., the land is "clean and healthy" with the appropriate measures to determine this)
21	Land monitoring provides the data, information and knowledge to guide the development of policy and performance measures around desired land management outcomes.
22	no
23	i think that Land Monitoring should be more closely linked with the Water for Life Strategy so that a truly integrated watershed approach can be achieved.
24	stay committed long-term, implement restoration of past failures if degradation is ongoing; limits to further rape & pillage of the surface features that result in stock piling revenues from resources that would otherwise remain for most likey both greater future value and less negative environmental consequences.

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Each individual respondent is referenced under the # column.

10. Please provide any other comments or suggestions to help shape the future directions of the planning process.

#	Response
1	Now do I get some Candy?
2	- could not answer above as not aware of inside information - I found this survey very difficult without greater detail of information wanted
3	Can't comment on Q9 because I am not with AENV and don't know their situation. We have shared knowledge and results of our monitoring program with AENV and SRD. We have not received reports from them.
4	While yet to be developed, there needs to be more land monitoring and evaluation (of success) related to some of Alberta's largest and potentially ecologically challenging developments such as Oil Sands Mining Sector and Coal Mine developments.
5	Objectives need to be set. Government seems unwilling to establish targets. There needs to be agreement on targets between departments. Communication between departments is getting better but there is still some us and them attitude. Financial resources for coordinating research and doing research is needed.
6	Think outside the box, including new survey tools beyond zoomerang
7	I am not that familiar with the Land Monitoring program therefore I did not respond to many questions in #9.
8	Alberta RiverWatch riverwatch@shaw.ca is interested in establishing partnership contacts with ABENV.
9	I don't know enough (aka anything) about the Land Monitoring Program and therefore can't provide much insight on what is being done well or not-so-well. I answered question 9 based on my experience with other sectors of AB Env - assuming the Land Management one is similar.
10	As a key prerequisite to this planning process, is there a clear understanding of the current provincial government philosophy/policy governing land monitoring initiatives?
11	Need to involve affected stakeholders adn regulators early on in land-based monitoring due to complexity of values for terrestial systems - ecological/aboriginal/municipal/Leasee Rights/economic values/protected areas
12	AENV must develop a corporate culture that wants to achieve sustainable decisions and will ensure that those decisions occur.
13	See comments to item 8.
14	Making industry accountable has to be in part a responsibility of the government. We need to be in touch by being visible.

15	Need to include industry much more to handle the research, data management, adaptive management, etc., have professional sign-off, and third party verification. AENV should focus on regulations only and enforcement of them. Let industry do the science and adaptive management, AENV should be a peer reviewer not a doer, approve precedures not dictate them. This will require AENV to have qualified personnel. Science and politics need to be separated and transparent.
16	I am uncertain of the existing goals and objectives of the LM program. Can only judge effectiveness by observation of Gov't departments that seem lacking in LM info.
17	ALthough I flagged a number of high barriers they can be addressed through a cultural commitment to SREM both within AENV and on a cross-ministry basis. The program needs to be explained clearly in the SREM world of shared outomes, integrated policy, effective delivery and performance assessment, all supported by information and knowledge, and all of this down in a new and elevated world of collaboration/partnership
18	none

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Land Monitoring Review
Matrix Solutions Inc.

Workshop Presentation

February 9, 2006 – Calgary

February 10, 2006 – Edmonton

- **Monitoring** – A system to supply information about a desired outcome and on which action would be taken to assure or achieve the outcome.
- **Partnership** - A relationship between individuals or groups characterized by mutual cooperation and responsibility, for the achievement of a specified goal.
- **Place Based** – An identifiable area, such as a watershed, in which planning, use and monitoring can be focused.
- **Outcome** - Outcomes are the results (both expected and unexpected) of either planned or unplanned actions or activities. For planning purposes, "outcomes" are the desired endpoint that guides the development.

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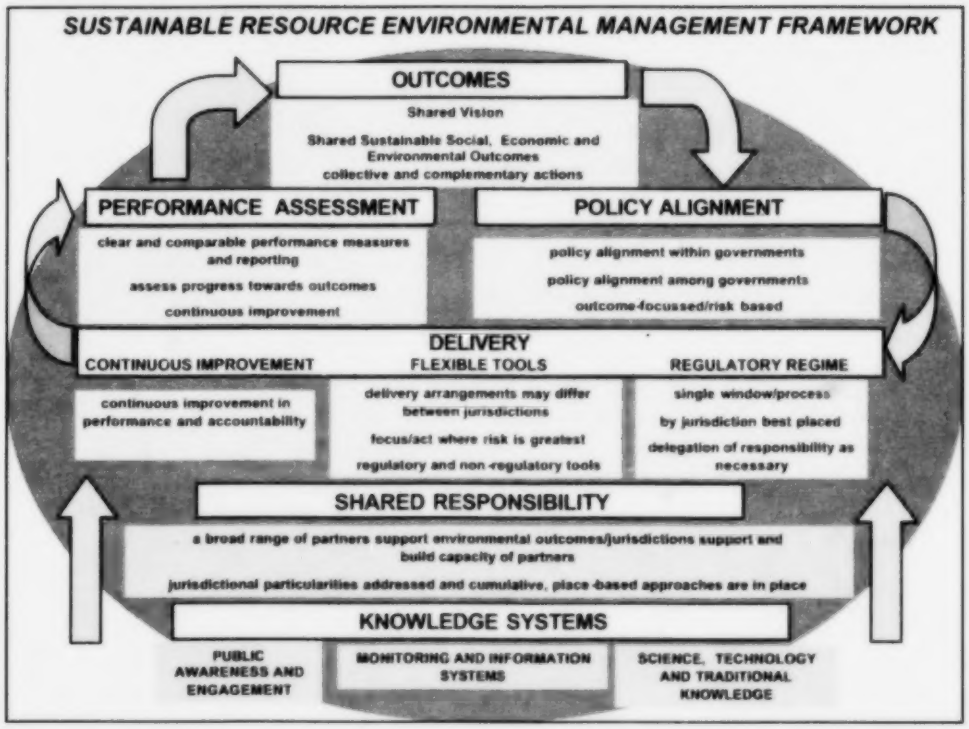

SUSTAINABLE RESOURCE ENVIRONMENTAL MANAGEMENT FRAMEWORK
OUTCOMES
Shared Vision
Shared Sustainable Social, Economic and Environmental Outcomes
collective and complementary actions
PERFORMANCE ASSESSMENT
clear and comparable performance measures and reporting
assess progress towards outcomes
continuous improvement
POLICY ALIGNMENT
policy alignment within governments
policy alignment among governments
outcome-focussed/risk based
DELIVERY
CONTINUOUS IMPROVEMENT
continuous improvement in performance and accountability
FLEXIBLE TOOLS
delivery arrangements may differ between jurisdictions
focus/act where risk is greatest
regulatory and non-regulatory tools
REGULATORY REGIME
single window/process
by jurisdiction best placed
delegation of responsibility as necessary
SHARED RESPONSIBILITY
a broad range of partners support environmental outcomes/jurisdictions support and build capacity of partners
jurisdictional particularities addressed and cumulative, place-based approaches are in place
KNOWLEDGE SYSTEMS
PUBLIC AWARENESS AND ENGAGEMENT
MONITORING AND INFORMATION SYSTEMS
SCIENCE, TECHNOLOGY AND TRADITIONAL KNOWLEDGE

Monitoring SREM

- State or condition of **key indicators** for land quality are established (Baseline of environmental condition, establish through monitoring).
- **Societal goals and objectives** for land quality are known (Outcomes).
- **Scientific support** for meeting quality requirements during and after use (Knowledge systems, guidelines, policy, standards, criteria).
- Societal agreement on **consequences** of users not meeting or sustaining land quality (Action).
- **Causal relationships** between amount or intensity of use and effect to land quality are known (Trigger for action).
- **Focused monitoring** to determine if objectives are being met (Performance measured, knowledge systems).

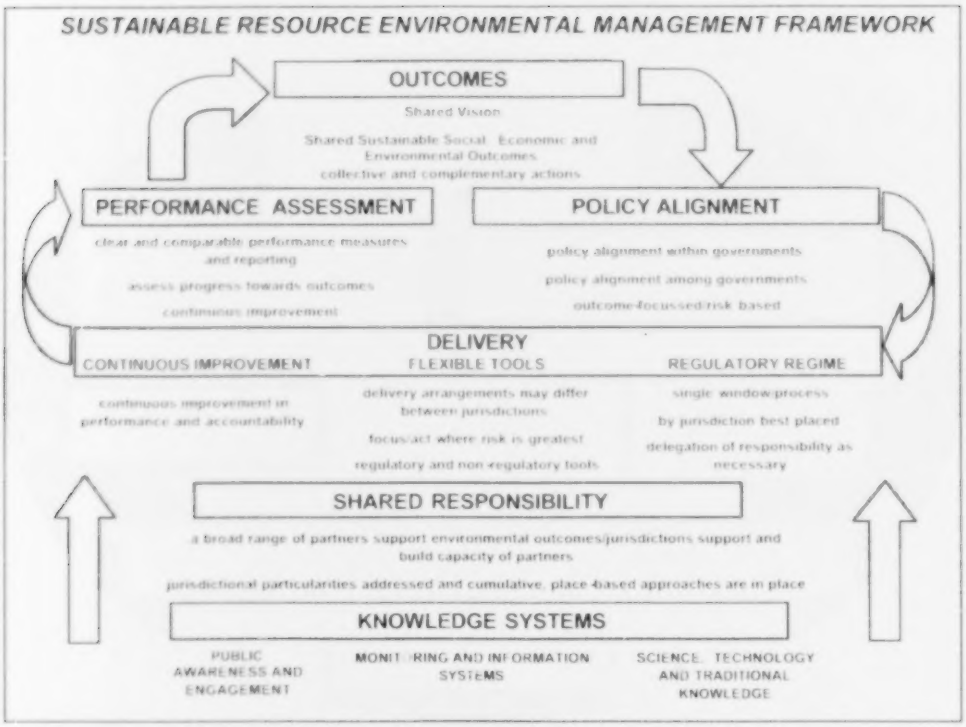
ject

- Through interviews, survey and workshops to gather information and opinion on:
  - Inventory of land monitoring programs, excluding waste management, linked to AENV mandate;
  - Gaps, barriers, needs and opportunities for land monitoring in the changing government framework, with reference to Sustainable Resource Environmental Management (SREM); and
  - Roles and responsibilities for AENV.

Surveys

AENV – Regulatory, Approvals and Complaint Driven

- Reclamation and Remediation:
  - Upstream Oil and Gas Facilities;
  - Mining (coal, sand, gravel); and
  - Oilsands.
- Soil Monitoring Program for Approved facilities.
- Soil Monitoring under the Air Monitoring Directive – at approved facilities handling solid sulphur.
- Environmental Impact Assessments.
- Pesticide sales inventory (required under Pesticide Regulation).
- Pipeline conservation and reclamation plans.
- Contaminated sites – non approved.
- Petroleum Storage Tanks.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The Ideal World of Land Monitoring
Matrix Proposal Based on SREM

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Program Inventory
Summary of Interviews and Surveys

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...rveys (con't)

AENV – non-regulatory

- Long term acidification plots.
- Ambient metals – current and historical programs.
- Land spreading of pulp mill sludge – guidelines for application in place, no follow up monitoring or auditing, part of waste management strategy.
- Biosolids spreading and wastewater irrigation:
  - Requires baseline and monitoring data. Part of waste management strategy.

Non–AENV but linked to AENV through approvals

- Cumulative Environmental Management Association – required to exist through approvals, directs its own research:
  - Vegetation and Soil Monitoring Working Group.
- Syncrude Oilsands Reclamation Research – required by approval but extent and development set by Syncrude beyond basics of approval. Informs operations decisions.
- Coal Mine reclamation research – required by approval but extent of research beyond approval basis.
- Oilfield waste management facilities.

...rveys (con't)

Other Programs, Non–AENV

- Terrestrial Environmental Effects Monitoring program (Wood Buffalo Environmental Association):
  - Government bodies invited to be part of the group.
- Natural Resources Conservation Board:
  - Soil information required at baseline for confined feeding operations.
- Other government jurisdictions – ASRD rangeland monitoring program, forestry reclamation, Turtle Mountain Geological Monitoring, Agriculture and Agri-Food Canada soil quality benchmark plots, monitoring for EUB facilities (groundwater).

...rveys (con't)

Other Programs (continued)

- Biodiversity Monitoring Project:
  - proposed long term monitoring program to establish the range of natural variability; developing landscape metrics.
- Bow River Balsam Poplar Restoration Project.

...es ...Results)

Strong Regulatory Goals

- Meeting approval requirements on site by site basis.
- Assurance to the public that land in use for resource extraction and other temporary uses is returned to equivalent capability.
- Encourage site management to prevent contamination on and off industrial facilities.
- Encourage clean up during life of facility; no orphan contaminated sites, limit liability to company and province.

Program Inventory
Summary of Interviews and Surveys (con't)

AENV – non-regulatory

- Long-term acidification plots.
- Ambient metals – current and historical programs.
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Program Inventory
Summary of Interviews and Surveys (con't)

Other Programs (continued)

- Biodiversity Monitoring Project:
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- Bow River Balsam Poplar Restoration Project.

Goals and Objectives
ENV Programs (Interview Results)

Strong Regulatory Goals

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Non-Regulatory Goals

- Non-regulatory goals of reporting on the state of the environment (SOE) are poorly supported by monitoring programs.
  - The long term acidification monitoring plots and some of the ambient metals work support SOE objectives.

1. State of the environment reporting:
   - Requires information on:
     - condition;
     - pressures; and
     - stewardship.
2. Coordinated monitoring toward common outcomes;
   - Multiple diverse and disparate goals.
3. Delivery of monitoring through partnerships.
4. Define the desired outcomes before instituting or amalgamating monitoring programs.
5. Central collection, coordination and evaluation of monitoring data – existing and new data.

eds

6. Monitoring focused on indicators that support management decisions.
7. Develop metrics meaningful to the public and for land management.
8. Scientific support for the metrics.
9. Uphold EPEA.
10. Determine trigger points for action.
11. Fill in the gaps between point source monitoring and regional or provincial scale data.

W

1. Limitation of government resources – must do better not necessarily more.
2. Lack of a cohesive, public "vision" of land as a shared, valuable resource – implications to quality, use priorities, value, current condition, conflict resolution.
3. What will motivate partners? What is the value of land monitoring for them?
4. Amount of resources required to determine the current state of the environment, using both existing and new monitoring programs.

Goals and Objectives – Interview Results (con't)

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Land Monitoring Needs Interview Results

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Gaps and Barriers Identified in Interviews

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3. What will motivate partners? What is the value of land monitoring for them?
4. Amount of resources required to determine the current state of the environment, using both existing and new monitoring programs.

(con't)

5. The gap between point source monitoring data and regional or place based management initiatives (e.g. watershed management groups).

6. Government silos and fractured land mandate stand in the way of collective, outcome driven land management and associated land monitoring.

7. Unequal application of land goals and quality requirements among users – agricultural private owners, agricultural corporate owners, Confined Feeding Operations, forestry, oilsands, conventional oil and gas, linear development, residential development.

8. Lack of centralized collection of data from existing programs .

...ws

1. Partnerships:
   - inter-government;
   - watershed management groups; and
   - grass roots groups.
2. Define roles and responsibilities.
3. Cumulative effects focus.
4. Focus on condition and pressures on land.
5. Amalgamate and coordinate existing and future data.
6. More?

- 40 completed surveys.
- Respondents:
  - 17 from AENV;
  - 5 from Other GoA Departments (SRD, AAFRD, Community Development);
  - 2 from EUB;
  - 2 from NRCB;
  - 2 from Government of Canada;
  - 4 from Business / Industry;
  - 5 from Non-profit; and
  - 1 from Research organization.

Monitoring

- 14 AENV employees:
  - 4 with land monitoring responsibilities; and
  - 11 with other AENV groups.
- 2 Partners with AENV in the Land monitoring projects and programs.
- 9 Contribute to policy development.
- 1 Supplies data to meet regulatory requirements.
- 5 Other – EUB, Use reports from AENV, involved in specific projects, or involved in watershed partnerships.
- 5 had no previous involvement – little background.

Gaps and Barriers Identified in Interviews (con't)

5. The gap between point source monitoring data and regional or place based management initiatives (e.g. watershed management groups).

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Opportunities Identified in Interviews

1. Partnerships:
   - inter government;
   - watershed management groups; and
   - grass roots groups.
2. Define roles and responsibilities.
3. Cumulative effects focus.
4. Focus on condition and pressures on land.
5. Amalgamate and coordinate existing and future data.
6. More?

Survey Responses

- 40 completed surveys.
- Respondents:
  - 17 from AENV;
  - 5 from Other GoA Departments (SRD, AAFRD, Community Development);
  - 2 from EUB;
  - 2 from NRCB;
  - 2 from Government of Canada;
  - 4 from Business / Industry;
  - 5 from Non-profit; and
  - 1 from Research organization.

Involvement with AENV Land Monitoring

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- 5 had no previous involvement – little background.

currently ograms?

- 17 responses:
  - 11 indicated programs to meet regulatory requirements:
    - Reclamation and follow up monitoring – public and private land;
    - Spill reporting;
    - Regulation regarding application of animal manure; and
    - Plot monitoring for CEMA and Cardinal River Coal.
  - 2 land monitoring programs:
    - 1 local level indicator program in existence for 3+ years; and
    - Agriculture and Agri-Food Canada soil quality monitoring plots.
  - 3 land related projects:
    - Fencing water ways to control cattle access;
    - Bow River Balsam Poplar Restoration Project; and
    - ANHIC - rare species mapping.

ur organization onitoring?

- Communication:
  - Cross ministry; and
  - External – What is the mandate?
    What is land monitoring?
- Leadership:
  - Within SREM; and
  - In identifying land issues.
- Science:
  - Cumulative effects of multi-industry use;
  - Reclamation - how to meet equivalent capability;
  - Trend analysis;
  - Land changes linked to related pressures; and
  - Soil chemical and physical quality data:
    - spatial distribution; and
    - natural occurrence.

...ur organization ...itoring? (con't)

- State of the Environment (SOE) reporting:
  - Types of industry pressures;
  - Reclamation status;
  - Contamination; and
  - Indicators – what condition are they in?
- Performance measures:
  - Against policy and program goals.
- Data access and management:
  - Storage, aggregation and access to data; and
  - Evaluation and trend analysis.
- Funding:
  - Volunteers and NGOs.

...monitoring

- Communications:
  - Cross ministry; and
  - External – up to date information.
- Data:
  - Not cohesively managed or collected;
  - Gap in data for provincial picture; and
  - Information lacking on land uses.

Does your organization currently have land monitoring programs?

- 17 responses:
  - 11 indicated programs to meet regulatory requirements:
    - Reclamation and follow up monitoring – public and private land;
    - Spill reporting;
    - Regulation regarding application of animal manures; and
    - Plan monitoring for CLMA and Cardinal River Coal.
  - 2 land monitoring programs:
    - Local level indicator program in existence for 5+ years; and
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  - 3 land related projects:
    - Fencing water ways to control cattle access;
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    - ANHIC – rare species mapping.

What information or services does your organization currently get most from AENV land monitoring?

- Communication:
  - Cross ministry; and
  - External – What is the mandate?
    What is land monitoring?
- Leadership:
  - Within SRD; and
  - In identifying land issues.
- Science:
  - Cumulative effects of multi-industry use;
  - Reclamation – how to meet equivalent capability;
  - Trend analyses;
  - Land changes linked to related pressures; and
  - Soil chemical and physical quality data:
    - spatial distribution; and
    - natural occurrence.

What information or services does your organization require most from AENV land monitoring? (con't)

- State of the Environment (SOE) reporting:
  - Types of industry pressures;
  - Reclamation status;
  - Contamination; and
  - Indicators – what condition are they in?
- Performance measures:
  - Against policy and program goals.
- Data access and management:
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- Funding:
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Identification of gaps in land monitoring as it applies to AENV?

- Communications:
  - Cross ministry; and
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- Data:
  - Not cohesively managed or collected;
  - Gap in data for provincial picture; and
  - Information lacking on land uses.

n land
AENV?

- Research and Science:
  - Cumulative effects;
  - Standardization of protocols;
  - What is the land link with watersheds? How to represent it in watershed management?
  - Reclamation:
    - calibration of reclamation effectiveness with soil data; and
    - post reclamation monitoring.
- Management:
  - Link with land use strategy – political will;
  - Monitoring linked to areas of large land disturbance;
  - Transparency and confidence in the audit process; and
  - Effective cross ministry coordination and management of land mandate.

nitoring
V?

- Multiple land management and land monitoring initiatives exist – are they all working together toward a common end?
- Planning on a watershed basis has difficulty in coordinating the different government silos – now add land, where does it fit in?
- Groups outside the government are also doing land monitoring, but with poor links to government input/output.

of AENV
am?

■ Land monitoring programs assure that AENV is able to measure performance in achieving defined outcomes for environmental management.	■ 19 respondents, 51%
■ Land monitoring provides accurate and timely information to support SREM, our partners' decision making is guided by quality land monitoring information.	■ 17 respondents, 46%
■ Land monitoring programs assure that AENV's regulatory responsibilities are met.	■ 1 respondent, 3%

AENV land

- Support for the land strategy.
- Breaking down the silos within government.
- Operational and funding partnerships.
- Alberta Government focus rather than just AENV.
- Land stewardship and guiding land management.
- Monitoring for it's own sake is of limited value.
- Tracking variability of soil distribution and quality.
- Credible monitoring information that is accessible to all.
- Measure performance.

Identification of gaps in land monitoring as it applies to AENV?

- Research and Science:
  - Cumulative effects
  - Standardization of protocols
  - What is the land link with watersheds? How to represent it in watershed management?
  - Reclamation:
    - calibration of reclamation effectiveness (soil and flora) and
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  - Monitoring linked to areas of large land disturbance
  - Transparency and confidence in the audit process and
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Duplications in land monitoring as it applies to AENV?

- Multiple land management and land monitoring initiatives exist – are they all working together toward a common end?
- Planning on a watershed basis has difficulty in coordinating the different government silos – now add land, where does it fit in?
- Groups outside the government are also doing land monitoring, but with poor links to government input/output.

Most important outcome of AENV land monitoring program?

- Land monitoring programs assure that AENV is able to measure performance in achieving selected outcomes for environmental management.
- 17 respondents, 41%
- Land monitoring provides accurate and timely information to support SREM, our partners' decision making as guided by quality land monitoring assessment.
- 17 respondents, 41%
- Land monitoring programs assure that AENV's regulatory responsibilities are met.
- 1 respondent, 2%

Other important outcomes of AENV land monitoring program?

- Support for the land strategy.
- Breaking down the silos within government.
- Operational and funding partnerships.
- Alberta Government focus rather than just AENV.
- Land stewardship and guiding land management.
- Monitoring for it's own sake is of limited value.
- Tracking variability of soil distribution and quality.
- Credible monitoring information that is accessible to all.
- Measure performance.

arriers to
mes?

What, if any, are the barriers to AENV land monitoring programs supporting the achievement of these outcomes. Please rate the level of your priority

The top percentage indicates total respondent ratio. The bottom number represents actual number of respondents selecting the option	1 High Barrier	2 Moderate Barrier	3 Low Barrier
1. Loss of people and expertise (corporate memory)	34% 12	51% 18	14% 5
2. Lack of a central repository for collected data and systematic analysis of data	68% 21	26% 9	6% 2
3. Lack of communication between departments	62% 21	29% 10	9% 3
4. Lack of financial resources	35% 12	62% 21	3% 1
5. Need for more partnership involvement	29% 10	60% 21	11% 4
6. Need for a different focus for Land Monitoring at AENV	16% 5	42% 13	42% 13
7. Need to establish acceptable standards, guidelines and thresholds for monitoring parameters	42% 14	42% 14	15% 5

- AENV land monitoring is currently strongly focused on upholding regulatory outcomes, yet respondents to the survey and interviewees indicated that SOE indicators, performance measures for the state of the environment and policy effectiveness, and reporting is a key land monitoring need.
- Cross ministry communications, mandate and coordinated approach is key to the future of land monitoring in support of land management.
- Research and science are key needs in land monitoring.
- Outside of government jurisdictions and regulatory approval holders, government land monitoring mandates and initiatives may not be well known.

Question 1

Given the needs for land monitoring identified in the survey and interviews, discuss the following in context of meeting these needs:

- Opportunities and organizations for partnerships in land monitoring;
- Gaps, duplications and synergies in existing programs; and
- Barriers to achieving partnerships and synergies, and possible ways to overcome these barriers.

Question 2

Given the needs for land monitoring identified in the survey & through the interviews, what are the roles and responsibilities for AENV in land monitoring to meet these needs?

- Regulatory;
- Non-regulatory;
- Support of other jurisdiction's programs; and
- Support of large scale strategies such as integrated land management strategy, SREM, Southern Alberta Sustainability Strategy, etc.

Are any of the following barriers to the monitoring outcomes?

Summary Comments

- MENV land monitoring is currently strongly focused on upholding regulatory outcomes, yet respondents to the survey and interviewees indicated that SOE indicators, performance measures for the state of the environment and policy effectiveness, and reporting is a key land monitoring need.
- Cross ministry communications, mandate and coordinated approach is key to the future of land monitoring in support of land management.
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Workshop

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Workshop

Question 2

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- Regulatory;
- Non regulatory;
- Support of other jurisdiction's programs; and
- Support of large scale strategies such as integrated land management strategy, SREM, Southern Alberta Sustainability Strategy, etc.

APPENDIX C

LAND MONITORING PROGRAM
INVENTORY AND OUTCOME ANALYSIS
INTERIM REPORT

Matrix Solutions Inc.
ENVIRONMENTAL CONSULTANTS

APPENDIX C
ALBERTA ENVIRONMENT
LAND MONITORING PROGRAM INVENTORY
AND OUTCOME ANALYSIS
INTERIM REPORT

Report Prepared for:

ALBERTA ENVIRONMENT

Prepared by:

MATRIX SOLUTIONS INC.

(Original signed by)

Elizabeth McNaughtan, P.Ag., MBA
Project Consultant

(Original signed by)

reviewed by
Pat Reid, P.Ag.
Principal Agrologist

(Original signed by)

reviewed by
Leo Bouckhout, P.Biol.
Vice President, International

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Calgary, Alberta

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1.0 INTRODUCTION

Matrix Solutions Inc. (Matrix) was contracted by Alberta Environment (AENV) in December, 2005, to complete a review of land monitoring programs under the mandate of AENV (excluding waste management programs). The results of the review were to be compiled into an inventory of current and historical programs, a list of outcomes from these programs, and a discussion of links between the existing programs and strategic initiatives taking place in AENV. The inventory process and results are included in this document, as an interim report in the land monitoring program review project. This report will form an appendix of the final project report.

2.0 METHODOLOGY

The inventory was derived from information obtained from employees of AENV and a few select outside agencies and companies, through a series of interviews carried out in January 2006. The inventory gathered information on historic and current programs of land monitoring but excluded waste management monitoring programs, which are being addressed under the waste management strategy.

A question guide was developed in conjunction with AENV team members in December, 2005, for the interviews to ensure that certain basic topics were discussed in each interview. The question guide (Appendix C1) was organized under the main headings of:

- Program information;
- Program history;
- Description of the program;
- Outcomes of the program;
- Monitoring information;
- Evaluation and review;
- Scope of the Program; and
- Future land monitoring needs.

An invitation to take part in the interviews was sent by AENV on December 20, 2005, to twenty-five people. Matrix followed up with a phone call to each person to set up an interview. At that time, the question guide was sent via e-mail to each interviewee.

Matrix conducted twenty-five interviews, primarily in person, over the month of January 2006, in Edmonton, Calgary and Lethbridge. Three interviews were conducted by telephone. Two workshops were held in early March, but focused on future needs and gaps and opportunities for land monitoring. Results of the workshops will be more fully integrated into the final report. The report is a synthesis of comments received in the interviews, interpreted in relation to the discussion put forward in the document. The inventory presented in Appendix C2 summarizes the information and views expressed by the interviewees regarding monitoring programs.

3.0 INVENTORY OF HISTORICAL AND CURRENT LAND MONITORING PROGRAMS

3.1 Current and Historical AENV Programs

Six general topical areas governing land monitoring programs within AENV were identified in the inventory process. In these six areas, 13 programs were described and are included in the detailed inventory of the programs found in Appendix C2. The six areas included:

1. Reclamation and remediation for several industrial activities:

    a. Upstream oil and gas sites;
    b. Mining sites – sand, gravel, coal, oil sands; and
    c. Conservation and reclamation plans for regulated pipelines.

2. Soil monitoring at approved facilities and contaminated sites:

    a. Includes the Soil Management Program and the Air Monitoring Directive (AMD) soil monitoring program around solid sulphur handling facilities; and
    b. Petroleum storage tank release monitoring.

3. Effects of acidic deposition on terrestrial ecosystems:

    a. Several approval related, industry sponsored programs; and
    b. AENV long term soil acidification monitoring.

4. Environmental Impact Assessment (EIA).

5. Soil metals.

6. Pesticide sales inventory.

Of the programs identified, most were developed to fulfill regulatory requirements set out in the Environmental Protection and Enhancement Act (EPEA) and involve approval conditions at regulated industrial facilities. Two of the thirteen programs are long-term ambient monitoring (ambient metals and long-term acidification monitoring program) programs which support the collection of data for eventual evaluation of the effects of deposition to land.

All of the programs are science based in the sense that they rely on guidelines, criteria and codes of practice for the basis of the work done on sites and these knowledge tools are developed based on science related to human health risk assessment. The reclamation guidelines are based on diverse scientific input; however, the reclamation certification program within AENV is an administrative program in which success of reclamation is inferred by the application process rather than post reclamation monitoring or sites. As well, the move to third party sign off in the contaminant assessment programs removes the programs from active monitoring of contaminant levels by AENV to qualitative assurance of work being undertaken. Both of these programs rely on the strength of knowledge products developed to guide reclamation and remediation rather than on direct monitoring.

3.1.1 Programs to Fulfill Regulatory Requirements

There is a clear mandate within AENV regarding regulatory responsibilities for the environment, recognized by those in regulated industries. As it relates to land, EPEA sets out a duty to report releases, conserve and reclaim specified land, and obtain a reclamation certificate in

respect of the conservation and reclamation (Section 137 (1)). AENV cooperates with other departments to effectively manage environmental issues for facilities and operations on lands managed by other departments. For example, the criteria and regulations governing reclamation and remediation have been made applicable to all reclamation in the province, including public land, but are administered for public land leases by Sustainable Resource Development (SRD).

3.1.1.1 *Reclamation and Remediation Programs*

The Reclamation and Remediation Program began with the issuance of the first reclamation certificates in the 1960s under the Mines and Minerals Act and the Surface Lands Act. In response to complaints, the reclamation program evolved over the 1970s and 1980s, for both mining and oil and gas, and took on its current form when EPEA was enacted in 1993. Along with reclamation of the surface, the program now incorporates evaluation for chemical impacts from industrial activities on oil and gas sites. The complete program is aimed at assuring contamination and reclamation issues are resolved on a site by site basis by the operators.

The Reclamation and Remediation Program for upstream oil and gas sites is the most strongly developed and most widely applied monitoring program, with defined program level outcomes, links to mid and high level outcomes, and an action component related to behavioural change in industry. The action is based on the Licensee Liability Rating (LLR), a government/industry program (coordinated through the Alberta Energy and Utilities Board; EUB) that assesses a licensee's ability to address their abandonment and reclamation liabilities. This assessment is based on a comparison of a company's deemed assets to its deemed environmental liabilities, and requires management of the resulting ratio. This provides an incentive to industry to complete the evaluation of sites toward application for reclamation, and has motivated companies to undertake the process to move an abandoned site through the reclamation certification process. Since the Program is applied to all oil and gas facilities, it is not limited by the approval process.

The Program has been well established since the 1960s, but continues to change with improved guidelines, criteria and technology, for site investigation, both at desktop and field levels. This has allowed a transition to an audit process from a process of site by site investigation by

AENV. In support of the audit process, AENV is moving toward requiring certification of environmental practitioners carrying out site investigations. Site information is gathered on chemical and physical characteristics of the site. The risk assessment guidelines for evaluating chemical guidelines have become standard for site evaluations in this and other programs. As well, program statistics are being gathered to determine the program effectiveness in dealing with reclamation applications.

The Reclamation Guidelines use soil condition parameters to estimate equivalent land capability. The parameters used are depth of surface soil, stoniness, admixing, compaction and vegetative cover. Depth of surface soil is the only parameter linked to conservation of soil, and the conservation of specified land identified in EPEA is poorly represented in the regulatory monitoring program. The weakness of the program is the lack of information on what constitutes equivalent land capability and on what soil handling practises best achieve it. Hence, strengthening the program could include establishing long term monitoring of reclaimed sites in both forested and agricultural settings, to determine what combination of soil conditions, handling procedures, and revegetation regimes produce equivalent land capability, in conjunction with a research process that evaluates essential physical, biological, chemical and hydrologic characteristics of reclaimed land.

The Conservation and Reclamation Program requirements for prairie mines have been developed based on years of research on soil replacement depths, landscape reclamation and revegetation. Oil sands reclamation research is underway, largely conducted by individual companies, and focused on watershed reconstruction. The proportion of reclaimed land to disturbed land in the oil sands is reported by AENV as a State of the Environment (SOE) indicator. AENV's sand and gravel program is applicable to developments on private land throughout the province. Other ministries govern development on public lands. The industry operates under a Code of Practice that requires a report every 5 years which may not provide timely information.

In general, the link is strong between reclamation programs and the EPEA and several stated goals and outcomes of the Government of Alberta (GoA). The EPEA identifies reclamation and remediation as duties of land users and identifies equivalent land capability as the end goal of reclamation. The role of AENV as the regulator in the reclamation programs is well understood

by stakeholders. One of the clear advantages is the link to a consequence through the EUB's LLR program. Without this link, the Reclamation and Remediation Program has no trigger for land management action by land users related to environmental management objectives of the GoA. The incentive program resides in another government body other than AENV, requiring sharing of data and a shared desire for a particular environmental outcome.

Equivalent land capability is the high level outcome for reclamation; however, different industrial operations (coal mines, pipelines, oil sands mines, etc.) use different mechanisms for estimating land capability, and these mechanisms are not linked or integrated. This means that application of reclamation and remediation standards may be unevenly applied depending on the industry involved.

3.1.1.2 *Soil Contamination Programs*

The programs aimed at monitoring releases to soil at approved facilities and from tanks had their origins in the 1980s with the monitoring of solid sulphur deposition on land around sour gas plants, with further refinement and additions after EPEA was enacted. Approval conditions on industrial facilities constitute the mechanism through which land monitoring programs and resulting management changes are institutionalized within industry, but approval conditions govern only a fraction of industrial activities on land. Approval conditions generally arise from past experience with industrial land uses and are limited to large scale facilities with potential for large scale releases. For those sites with approval conditions, there is a feedback loop from monitored land condition to site management through ongoing annual management plans, making these programs relatively successful in driving environmental management changes. As those sites that don't require approval conditions outnumber those that do, the extent of changes in land management throughout the industries governed is unknown. Physical and biological characteristics of the land are not evaluated at sites where the issue is a release from a petroleum storage tank (PST), so equivalent land capability at these sites cannot be assured. However, non-approved sites, such as a well site where a tank release has occurred, must also go through the reclamation certification process at the end of life, and comply with the requirements of that process. There is also a duty for operators to report releases.

Establishing equivalent land capability is linked to the development of guidelines, standards, criteria and codes of practices, rather than direct monitoring. The move in both the reclamation certification program and the contaminated sites program to the use of professional sign off and auditing, raises the question of the level of assurance to the public which can be provided by AENV. The application of audit rules means that assurance of equivalent capability is based on the statistical probability of random investigation identifying a remedial issue and relying on the audit process followed to encourage proactive industrial behaviour. It does not provide the level of assurance that would be provided if AENV used extensive site investigation to measure and validate that the physical, chemical and biological components are conserved and reclaimed to an equivalent land capability.

3.1.1.3 *Acid Deposition Monitoring Programs*

AENV has an acid deposition monitoring program that has been in place for twenty-five years. The Long-term Soil Acidification Monitoring Program was initiated in the 1980s when significant academic research was carried out on acid deposition across Alberta. With twenty-five years of data the program is now able to carry out trend analysis. The program is considered an ambient monitoring program as it is not linked to EPEA and regulatory requirements; however, it does link to several other programs in place to monitor acid deposition which are required by approval conditions. Most of these other programs are run by multi-stakeholder groups organized in the Athabasca oil sands region to coordinate research and monitoring programs that are stipulated as approval conditions for oil sands operators. These programs include three research and monitoring programs in the oil sands area of northeast Alberta. Two of these programs are run by multi-stakeholder organizations (Cumulative Environmental Management Association (CEMA) and the Wood Buffalo Environmental Association (WBEA)) of which AENV is a member and has access to collected data. A predictive model within AENV, that utilizes the acid deposition plot data and baseline EIA data, has not been established.

3.1.1.4 *Environmental Impact Assessments*

EIAs are required under EPEA for regulated activities and the hearing administration process is referred to either the Natural Resources Conservation Board (NRCB) or the EUB. After the gathering of baseline data, an estimation of potential impacts from development and cumulative

impacts in the area is made. The predictions are reviewed by AENV and approval conditions are set.

The collective data set from EIAs is large but difficult to access. The electronic versions of data are held by consultants and some consider these to be proprietary. The data is public information, but generally available in paper formats through the government. The amalgamation of the data to contribute to any large scale regional data bank would be a time consuming task. As well, data collection and evaluation methods may change, so direct site by site comparison and evaluation of data may not be useful.

The combination of the EIA soils and landform data with data collected in research and monitoring programs by approval holders after development could provide information for predictive modeling and cause and effect analysis, but would require significant resources. In areas with ongoing development, this is a significant data pool to use toward evaluation of land use on land quality and the ability to reclaim to equivalent land capability.

As well, the EIA process requires the development of conservation and reclamation plans based on baseline soil data. The success of these plans has not been evaluated. The opportunity to monitor reclamation success and link it to soil handling practices has not been institutionalized in the reclamation programs. There is a good opportunity to do reclamation success monitoring on pipelines, which are reclaimed while still in use, and a process to evaluate reclamation success linked to soil handling and construction methods is underway for approved pipelines.

3.1.1.5 *Success of Regulatory Related Programs*

The programs related to monitoring of land on approved facilities and for reclamation are generally successful in achieving compliance with environmental criteria and guidelines on specified lands. However, the goal of environmental stewardship is to drive beneficial behaviour in situations not governed by compliance with regulatory requirements. The regulatory programs of AENV are not set up to determine if beneficial environmental management decisions are made outside of the regulatory compliance framework. This indicates that AENV is prepared to develop information systems and manage land issues related to contamination and reclamation through the approval and certificate programs for mining, regulated pipelines

and oil and gas approved facilities. However, the extent of the monitoring required in other industries (e.g., confined feeding operations) and unregulated portions of resource extraction industries (e.g., Class II pipelines) does not match that of the mining and oil and gas industries, and there is unequal application of regulatory driven programs across industries. Because of unequal application, institutionalized management change with regard to soil management practises cannot be guaranteed across industries. This unequal application gives rise to several gaps in monitoring information usefulness, including:

- A gap in cause and effect evaluation of reclamation success associated with soil handling and management.

- A lack in utilizing and coordinating collected data for larger scale evaluation of land condition.

- A gap in ability to evaluate effectiveness of policy, standards and guidelines in changing behaviour.

- Gaps in knowledge and lack of predictive modeling on impact to land from various land uses.

- Programs are not clearly linked to conservation of land resources.

- No process to link codes, criteria, or guidelines to higher level outcomes.

The Reclamation Criteria and Soil Management Programs are under review at this time, to identify strengths and weaknesses in the criteria and program structures.

3.1.2 Ambient Information Programs

Other than the Long-term Acid Deposition Monitoring Program, there are two ambient monitoring programs; the Pesticide Sales Inventory Program, and the Soil Metals Program. The Pesticide Sales Inventory is primarily used to infer scale and source of potential impact from pesticides to water quality, as well as to compare pesticide use in Alberta with other

jurisdictions. The Soil Metals Programs were developed to determine natural variability and to establish metal concentration ranges under different land use patterns. The latter two programs are examples of monitoring for non-point source data that can be related to watershed protection, but which are not now used explicitly for those purposes.

3.2 Non-Alberta Environment Programs

A number of programs were identified as being administered in organizations outside of AENV. These included programs run by other Government of Alberta departments, other levels of government and independent organizations. The investigation of other programs was not intended to be extensive and inclusive, but rather to identify some land monitoring endeavours underway in other organizations. The programs fell into the following categories:

- programs to meet a regulatory requirement;
- programs to meet a public safety requirement;
- programs in place to enhance management of public land; and
- programs proposed for provincial level data collection.

Some of the programs to meet regulatory requirements were described under Section 3.1.1.3, Acid Deposition Programs, and are required by approvals, but are administered by non-government organizations. AENV had responsibility for the Turtle Mountain Monitoring Program but it is now administered by the Alberta Geological Survey. This program has established four protocols for ensuring public safety related to instability of Turtle Mountain.

SRD's Program for Rangeland Management has over 50 years of data which have been used to support management objectives and guidelines and to prepare tools for users of rangeland. SRD has established consequences to users related to reduction of range health. Consequences can include loss of a lease. This monitoring program is highly focused on specific rangeland outcomes and includes the incentive to users related to consequences of not meeting those outcomes.

When fully funded, the Alberta Biodiversity Monitoring Program will have coverage of the province for biodiversity indicators, and will include data collection and reporting. The program

is in the process of developing landscape indicators. Biodiversity data will not be predictive of land, water or air impacts and issues, but will establish natural variability within biodiversity indicators. With natural variability established the level of risk that society is willing to accept for the indicator, can be addressed. The program requires $10 million per year to operate and would require approximately 11 years of data collection before estimations of natural variability could be made.

4.0 OUTCOMES OF LAND MONITORING PROGRAMS

Outcomes describe the desired endpoint or condition of the land. Defining outcomes requires the evaluation of environmental risk scenarios identified as important to Albertans, and describing the acceptable condition related to the environment. In the broadest sense, the risk of pollution to air, water and land as it links to health impacts on humans leads the environmental concerns for Albertans. Risk assessment in sustainable systems brings together risk scenarios with different outcomes in environment, economics, and social arenas., and the outcomes may not align. Through the initiation of the Sustainable Resource and Environment Management (SREM) framework, other cross ministries initiatives, water management plans, and the Land Use Framework for Alberta, the conflicting outcomes can be identified. It then becomes the focus of integrated management of resources to prioritize and manage the diverse risks identified in achieving the outcomes.

To be effective in supporting the new land and water management initiatives in the province, such as the Land Use Framework for Alberta, *and WPACs*, a hierarchy or cascade of outcomes is needed. Ideally, outcomes will be defined at the short term, medium term and long term levels, linking high level strategy to detailed programs such as land monitoring programs and specific site by site data. Until recently, medium term policy level outcomes which would foster program evaluation and behavioural analysis were missing from the cascade of outcomes. Recently, three land monitoring outcomes at a medium term and level have been identified by AENV:

- Land monitoring programs assure that AENV is able to measure performance in achieving defined outcomes for environmental management.

- Land monitoring provides accurate and timely information to support SREM; our partners' decision making is guided by quality land monitoring information.

- Land monitoring programs assure that AENV's regulatory responsibilities are met.

During the inventory interviews, outcomes for each of the programs were identified. These outcomes have been grouped according to the broad category of monitoring program and are tabulated in Appendix C3. The outcomes for the programs are generally detail level outcomes which provide a short term output from the program, but can be linked to higher level outcomes which are included in AENV's and other departments' vision statements, documents of strategic direction, and business plans (Appendix C3).

The current monitoring programs and their outcomes are strongly linked to the broad regulatory mandate established in EPEA and to the medium term regulatory outcome listed above. However, with the current format of data collection and the lack of coordinated evaluation on a program and regional basis, they cannot be easily used to determine effectiveness of policy and program delivery of environmental management in monitored landscapes. Resources are needed to evaluate the data already collected against the regulatory outcomes expected.

Opportunity exists to utilize the existing monitoring data toward evaluation of specific outcomes as envisioned in the three medium-term land monitoring outcomes identified by AENV and listed earlier in this section. Significant data are available from long and medium term acidification plots and EIAs which may be appropriate to evaluate acid deposition on a regional basis. However, utilizing data reports would require a budget for data amalgamation and interpretation, and would require stakeholder consultation to ensure the evaluation is seen as credible. This may be an opportunity to partner with an academic institution where multiple research projects could utilize the same data and would possibly provide labour for data amalgamation.

The ability to meet the information needs of SREM and ensure quality information for partners is not supported by the current programs except in the area of regulatory requirements where data sharing, standards and procedures, policy and management frameworks already exist between ASRD, AENV and the EUB. However, the development of common outcomes has not been

initiated, and a combined picture of program effectiveness on public and private lands has not been delivered.

5.0 LAND MONITORING PROGRAM SUPPORT OF ALBERTA ENVIRONMENT'S BUSINESS PLAN, STRATEGIES AND CROSS MINISTRY INITIATIVES

5.1 Alberta Environment's Business Plan

Alberta Environment's business plan for 2006 to 2009 sets out:

- Two areas of core business - Assuring Environmental Quality and Sharing Environmental Management and Stewardship.

- Three goals within those core areas - Alberta's environment is clean and safe, Albertans receive effective and efficient services, and Albertans work with others to safeguard the environment.

- Five strategic priorities - the Sustainable Resource Environmental Management Framework, water, climate change, using and respecting the land and staff capability.

Performance measures have been established for each of the core business areas, but there are no performance measures related to land, and the emphasis on land in the business plan is on developing a land use strategy and maintaining a commitment to resolving contamination and liability issues. Monitoring programs in place now strongly support the commitment to resolving contamination and liability issues, but the ability to evaluate management change on a broad, or even regional basis, is low as data are collected on a site by site basis.

The business plan includes identification of incentives and non-regulatory tools to ensure restoration of contaminated sites to productive capability. The reclamation and remediation program, with its link to the EUB's LLR program, is the most strongly and broadly developed program supporting these strategies. However, land monitoring in reclamation and remediation

is driven by the approval process, with little perceived incentive for monitoring outside the regulatory framework. Therefore, developing non-regulatory incentives is difficult to initiate.

In the core business area of assuring environmental quality, there are no performance measures related to land. The performance measure related to the river water quality index included in the performance measures does include parameters (metals, nutrients and pesticides) whose presence in the river system originates with non-point sources from adjacent land use. Land monitoring programs in place now are not used to directly link land quality or disturbance information in a surrounding watershed to water quality, even in the riparian zone adjacent to the river. The pesticide sales inventory can be reported on a watershed basis, and provides a strong opportunity to work together with the water monitoring teams, thereby possibly limiting the need for extensive land based pesticide monitoring data through the use of inferred pesticide use. The fit may not have the same accuracy as actual land monitoring but may be sufficient to provide a level of correlation between sales and river water quality. The same kind of opportunity exists for the soil metal monitoring data; however, the process to create the link with water monitoring is not in place.

Developing watershed management priorities and objectives is a strategy under assuring environmental quality, and has been initiated with Watershed Protection Advisory Councils (WPACs) in a number of watersheds. These groups are in evolution, but the opportunity exists to bring expertise from Alberta Environment to a number of areas, one of which is land, water and air monitoring to support the objectives set for quality and quantity of water in any given watershed. The data and information to support these objectives are not now readily available nor provided by a monitoring system established for this purpose. The data that are available may provide some insight but these are also scattered in various databases or paper files. The opportunity exists to design monitoring programs that link land use and land quality data to water quality and quantity for the watersheds, and to management decisions and consequences for the watershed users.

The contribution to development of a land use strategy is identified in the AENV business plan. In all of the interviews and workshop discussions, land use planning and evaluation was a priority of participants, yet there are no effective monitoring information networks to support land use frameworks. The difficulty lies in establishing the parameters to monitor, as they would

necessarily be those which identify trends in areas of management priority under a land use framework. Those areas of management priority have not been established in the province; but, as they are identified through the land use framework development, land monitoring programs will need to support cause and effect evaluation of land use so that effective management decisions and communication with the public can be achieved.

5.1.1 Initiatives for Place Based, Outcome Driven Integrated Resource Management

The AENV business plan also identifies the core business of sharing environmental management and stewardship, which includes sharing timely and credible information about the environment to support *Water for Life*, integrated resource management, partnerships and intergovernmental relationships. Several major initiatives are underway in this core business area within AENV, including:

- Place based environmental management strategies such as the Southern Alberta Sustainability Strategy (SASS);
- The Watershed Protection Advisory Councils (WPACs) and watershed plans;
- The SREM Framework endorsed as a cross ministry management system; and
- The Mineable Oil Sands Strategy (MOSS).

SASS, WPACs and MOSS are management level strategies that fit the systems view of SREM, and are in the process of developing management outcomes and associated indicators for which land monitoring will be needed.

In the development of SASS and the management plans for WPACs, land use and cause and effect evaluation of land use on land and water quality are required. These needs cannot be met by the existing AENV land monitoring programs. To develop a baseline land use picture, SASS required the use of eight or more data sets, which provided estimates of land cover and land use footprint. The aim of SASS is to provide a framework in which economic, environmental and social outcomes related to sustainability of the land and water base can be effectively managed, even when multiple desired outcomes are in conflict. Once the outcomes have been established within SASS, targeted land monitoring programs will be required at

regional and subregional levels, along with predictive modeling to determine trend and endpoint analysis linked to risk tolerance thresholds.

As stated above, WPACs require information linking land use and quality to the indicators of water quality identified in *Water for Life* and in the business plan performance measures. The monitoring data must, again, allow for trend analysis linked to risk tolerance thresholds and management actions.

The draft MOSS was issued in 2005 and is in ongoing discussion with stakeholders. It also is a management plan that identifies land monitoring needs on a regional basis. This strategy is closely linked to the approval and regulatory framework and can set the stage to optimize land monitoring in the area. Again, land monitoring data should be collected into a framework that allows modeling and evaluation of cause and effect in support of the Acid Deposition Framework already established in the area.

SREM indicates a desire for a collaborative approach and integrated outcomes, policy and programs to support the policy across government departments. Some higher level outcomes are equally applicable to different departments; however, supporting the mid level outcomes identified by the AENV land monitoring team will require significant groundwork between departments. The groundwork must relate the value of AENV land monitoring programs to the land mandate of SREM partners where it is most strongly established: within ASRD, the Department of Energy, and the Department of Municipal Affairs.

AENV's responsibilities for land, as identified in the business plan, relate to contamination and reclamation, a land use strategy, State of the Environment reporting, support of water quality initiatives and to support of place based management initiatives. Therefore, generating cross ministry support for AENV's role within land initiatives will be most successful when focused in these areas and developed with a value added approach to the other ministries' initiatives. In particular, AENV has a strong role in supporting provincial outcomes related to regulatory frameworks, through the development of best practices, standards, criteria and monitoring feedback.

A significant opportunity exists to lead the establishment of environmental outcomes, policy and evaluation related to the regional impacts from Coal Bed Methane (CBM) development, which is highly concentrated in the south central portion of the province and may potentially be almost fully developed within 3 to 5 years. While the development of CBM wells is similar to conventional oil and gas wells, the concentration of the resource and potential fragmentation, as well as land access issues and concerns related to potential surface water release and potential contamination of groundwater have raised the profile of CBM among landowners. Landowners look to AENV for interpretation of impact from these activities. Any CBM initiative would require a cross ministry approach to be effective for the various ministries and boards involved.

5.2 The Monitoring, Evaluation and Reporting Strategy

Alberta Environment has a monitoring, evaluation and reporting strategy which links access to reliable environmental data and information, identified in the business plan, to three initiatives of the monitoring evaluation and reporting department:

- AENV will coordinate the collection, analysis and availability of more environmental information from a variety of sources.

- Reliable State of the Environment information will be readily available and accessible to the public from shared electronic systems.

- Current State of the Environment reports will provide evaluation of trends and conditions in relation to accepted environmental outcomes to support management responses.

With respect to land monitoring and evaluation, initiatives are underway to improve public access to AENV site information through electronic systems, and the State of the Environment report was revamped in 2005. For land, the State of the Environment reports are not yet complete as they do not provide a comprehensive report on pressures, conditions and stewardship on all land within the province. Coordinated collection, analysis and availability of land related environmental information has not been supported by land monitoring programs or evaluation programs in place now. This is needed to support partnerships formed in large scale regional initiatives to develop shared outcomes and integrated resource management.

6.0 SUMMARY

The role of land within the AENV business plan is most strongly linked to four areas:

- Regulatory requirements for remediation and reclamation;
- Land use strategy;
- Support of the Water for Life strategy; and
- Place based management initiatives that recognize natural boundaries for land and water.

The inventory programs in place and the initiatives identified within the AENV business plan and strategies are in alignment on regulatory requirements. The Reclamation and Remediation Program has recently established program review and is linked with an incentive mechanism. However, several challenges and opportunities were identified for the role of land monitoring and information systems in supporting place based, outcome driven environmental management initiatives.

- Monitoring programs have not been formulated to support outcome driven, place based management systems. There is a gap between point source remediation and reclamation monitoring data and regional or place based management initiatives (e.g. watershed management groups). The ability to utilize existing data to support place based management may be limited.

- Leadership in accumulating data and utilizing it for predictive modeling is an opportunity. An example is the wealth of data in EIAs and acidification monitoring programs for the Athabasca Oil Sands, that is not brought together in a large scale regional model. Data collection, evaluation and accessibility are limited by the historical method of data delivery and establishment of models to evaluate the data.

- Government resources for new programs and evaluations are limited, requiring the help of partners.

- The development of outcomes for land monitoring linked to land management is most well developed around "clean land" through regulatory programs related to reclamation and

remediation. Developing the outcomes which will be managed in place based initiative is only beginning and monitoring program development may be minimal until those outcomes are determined.

- Monitoring data has not been utilized for cause and effect analysis linked to land use, which would be a major contribution to the land use strategy. With programs established now, this could be best accomplished in the reclamation programs, with longer term post-reclamation monitoring of equivalency to surrounding land capability. In terms of other land uses, and other potential impacts such as impact to water quality or quantity related to land use, monitoring is not in place to support predictive modeling.

- The fractured nature of the land mandate across government departments and the limited mandate regarding land within AENV indicate that AENVs role in providing land monitoring systems must support the mandate for land in other departments and the internal AENV mandate related to water and land use.

- Administrative performance measurement is obtained by some monitoring programs rather than direct soil or land monitoring data related to reclamation or remediation, which provides for evaluation of program effectiveness but does not provide data for evaluation of environmental management performance.

7.0 LIMITATIONS

We certify that we supervised and carried out the work as described in this report. The report is based on and limited by circumstances and conditions referred to throughout the report and on information available at the time of the site investigation. Matrix Solutions Inc. has exercised reasonable skill, care and diligence to assess the information acquired during the preparation of this report. Matrix Solutions Inc. believes this information is accurate but cannot guarantee or warrant its accuracy or completeness. Information provided by others was believed to be accurate but cannot be guaranteed.

The information presented in this report was acquired, compiled and interpreted exclusively for the purposes described in this report. Matrix Solutions Inc. does not accept any responsibility for the use of this report, in whole or in part, for any purpose other than intended or to any third party for use whatsoever.

APPENDIX C1

ALBERTA ENVIRONMENT MONITORING REVIEW INTERVIEW QUESTION GUIDE

APPENDIX C1

AENV LAND MONITORING REVIEW
INTERVIEW QUESTION GUIDE

Alberta Environment (AENV) has contracted with Matrix Solutions Inc. (Matrix) of Calgary to conduct a Land Monitoring Needs Analysis for AENV department activities. This work is being done under the direction of the Land Monitoring Team, an intra-departmental team of regional and head office staff involved in land monitoring programs and issues.

The objective of the project is to determine the historical and current work on land monitoring that AENV is, or has been, involved with in relation to its regulatory and non-regulatory functions. In addition, the work is anticipated to identify priority areas for focusing future land monitoring activities, in order to assist the Land Monitoring Team in moving forward in setting priorities for short and long-term monitoring programs.

The questions that follow are intended to guide and expedite the interview process. If you could take a few minutes before your interview to review the questions and jot down some responses to the questions, particularly in relation to the current and historical programs, that would assist Matrix and allow more time for discussion about future land monitoring needs. Matrix will be compiling an inventory of current and historical programs from the information collected, while the future land monitoring needs assessment will be addressed in a report.

Some examples of AENV land monitoring programs that have been identified include:

- soil monitoring at approved facilities;
- contaminated site monitoring;
- reclamation and remediation at upstream oil & gas facilities;
- mining reclamation monitoring;
- monitoring related to guideline/standard development (soil quality criteria, etc);
- regional planning;
- land use and environmental aspects;
- riparian and watershed monitoring;
- geotechnical monitoring; and
- long-term research projects that could almost be considered monitoring (e.g., coal mine reclamation vegetation plots), or short-term research projects that led to or could lead to monitoring programs.

Your name was put forward as an interview candidate because of your experience and background in specific program areas. You may have been directly or indirectly involved with a number of monitoring programs. The interview is intended to provide Matrix with sufficient information to provide a reasonably complete inventory of land monitoring activities, but more importantly, to develop an understanding and perspective of where AENV should be moving towards in terms of land monitoring.

Thank you for your participation.

Inventory of Current and Historical Land Monitoring Programs

Program Information

- Program name
- Program owner / champion / contact – historical contacts also
- Online linkages if any or address of contact

Program History

- What date was the program begun? What was the issue that prompted the program?
- Under what legislation / policy / guideline was it begun? Has this changed?
- Is the program the same as it was when initiated? What is the history of changes to the program?
- Who developed the program? (Please specify individuals/organizational units)
- Who is responsible for the information provided by the program?
- How is the program funded?
- Is it administered by AENV? Has it always been administered by the same group?
- What resources does it consume annually?

Description of the Program

- Why is the information being collected?
- What are the goals and objectives of the program?
- How does it relate to current legislation / policy / guidelines?
- How does the program link to strategies like Sustainable Resource and Environment Management (SREM)?
- Is it a required program or a voluntary program?
- How does the program link to other government jurisdictions or private groups carrying out monitoring or land decisions?
- Is there a trigger identified in the program for AENV to respond to or act upon land monitoring information?

Outcomes of the Program

- What outcome was envisioned for the program?
- Is the program providing the outcome envisioned?
- If different than envisioned, how is it different?
- Did information come to light that wasn't expected?
- Is there any intent to modify the program in the near future? If so, how?

Monitoring Information/Data

- What information/data are being collected?
- How is the information obtained?
- Where is it stored?
- Who has access to the information?
- What format is the information in?

- Has the information/data been converted to information and knowledge products (reports, guidelines, standards, policy, SOE indicators, etc)
- Is there a quality control / quality assurance process?
- With what frequency are the programs carried out?
- Are there issues of intellectual property? Privacy of information?

Evaluation & Review

- Is there a written evaluation (or another process) to evaluate program effectiveness? Describe it.
- Are there any performance measures or indicators associated with this monitoring program? If so, what are they?
- Has the evaluation been used to influence program tools (policy, programs, guidelines, standards, research, environmental indicators, etc)?
- How do the programs and information get used in decisions on land use / resource use? What kind of trigger would identify a land management issue?
- How could the programs be strengthened?
- Should the programs be changed?

Scope of the Program

- Who are the stakeholders in the program? Are there other stakeholders that would be natural stakeholders if the opportunity arose?
- What part(s) of the province are covered by the land monitoring program?

Future Land Monitoring Programs

- What should be the main areas of focus of AENV land monitoring programs in the future? What specific programs would support this focus?

- How do land monitoring programs fit the sustainable development vision?

- What do you think the outcomes of AENV land monitoring business are? Please refer to several different levels of AENV business (high level (provincial scope) and mid-level (e.g., program, region, watershed). What suggested indicators could be used to measure these outcomes?

- What kind of targets would you set to ensure that AENV outcomes are being met? Please include a timeframe if you can.

- What performance measurement indicators would you suggest are needed to achieve these targets?

- What are the issues facing land monitoring programs?

    - Funding?
    - Continuity?
    - Other

- What partnership opportunities are there in which land monitoring could be implemented?
- What objectives of partnership would you like to see?
- Would partnership work for all land monitoring programs?

APPENDIX C2

ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

APPENDIX C2

ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

REGULATORY RELATED PROGRAMS SOIL MONITORING DIRECTIVE (SMD) CONTAMINATED SITES	
Program Contacts	Interviewed • Chi Chen, • Steve Crudge, • Dave Gower, • Taras Pojasak; http://www3.gov.ab.ca/env/protenf/soilgrndwater/index.html
History of Program	Directive was initiated in 1990-1991, phased in. Prior to this, monitoring had been on a site by site basis. Specific requirements were included in each specific AEPEA approval to operate. Soil Monitoring Directive and Soil Management Guidelines were finalized in 1996 and standardized the monitoring program. Contaminated sites without approvals are not a formal program, rather are driven by standard environmental practices to prevent adverse effects.
Description of Program	The soil monitoring directive (SMD) was implemented to ensure that contaminated sites were addressed, to determine if industries are being environmentally responsible and to reduce releases. The information is gathered for risk management purposes, so that the sites can be monitored and remediation can be done in a timely manner (clean as you go approach) with the intent of preventing retained liability for the operator and the public. Soil impact is managed through an annual soil management plan. Contaminated sites informal program exists as the polluter has a duty to remediate. CEMA used as the mechanism for contaminated sites. This program is driven by the duty to report and by complaints. Goals for both the SMD and contaminated sites are driven by standard environmental practices to prevent adverse environmental effects which includes reducing the potential to impact groundwater. The program is currently a requirement for industry sites. The programs use a site based approach; each site is treated differently in the context of site specific background information. Neither program includes orphan sites, sites on crown land, or feed lots.
Outcomes and Changes	The SMD will be changed to 'Soil Monitoring, Management and Reporting' - planned for 2006 and there is a goal to integrate it with the Oil Sands. Partnership opportunities were identified with municipalities, developers, farm associations, industry groups, watershed groups, PFRA, SRD, Energy, Agriculture and EUB with EUB taking over the well site program. Future anticipated outcomes were identified as follows. • Modify AENV's role from a parent role to a coordinator role. • Transparent system to be used by all partners (similar to PST system which is on the web – screened for confidentiality and available to everyone) • A comprehensive database with consultants inputting data and reports (which are already in an electronic format) - this could allow for trend analysis, determining desired outcomes, setting targets (policy), show progress (regional, provincial, individual). The AEPEA approval would then reflect the regional goal which would then be a collective (place based) goal. • Anticipated outcome would be that data from this system is extracted to compile SOE report – address issues such as an overview of cumulative effects, amount of land disturbed, loss of agricultural land. • Informed holistic decisions such as how to handle waste (effective use of landfills) and track processes like the volatilizing of hydrocarbons that regularly occurs – track total volume and could have an idea of impact which could aid in making regulations. • Track releases province wide – how released, what, how much, provide and indicator of impact to environment – going up or down? Environment Canada has the NPRI website - AENV could have a similar website for electronic submission. • Identify indicators of environmental impact – Agriculture has soil quality benchmark sites – AENV needs to determine priorities of what indicators should be tracked such as how much of land is used for urban sprawl (could then have discussions with municipalities), total number of contaminated sites, number of sites cleaned up. • AENV's role as a combination of regulatory approach and partnership approach.
Monitoring Information	Paper copies of reports are submitted to AENV, tracked, scanned and stored electronically and as hard copy. Non approved sites are tracked only in the regional office. Industry is responsible for the monitoring and reporting and AENV funds the tracking and reviewing of the reports. SMD reports are required every 5 years as indicated in the approval with follow-up soil management reports typically on an annual basis; contaminated sites reports are determined between the site owner and the AENV regional reviewer. Approved sites must make information available to the public – this information is available through the Freedom of Information Act. SMD requires some QA/QC samples be taken. CAEL accreditation system provides analytical QA/QC. No formal requirement for QA/QC in contaminated sites program.

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REGULATORY RELATED PROGRAMS	
	In future reports will require sign off by an accredited professional
Legislation/Policies/guidelines/criteria supported by the Programs	SMD and contaminated sites begun under AEPEA Legislation drives duty to remediate. Policies are ad hoc and informal AENV passes on spill information to the EUB (partnership) Guidelines and criteria supported by the programs: • Regulatory guidelines including CCME, Alberta Tier I, Sulphur remediation, Salt guidelines and hydrocarbon guidelines. • The laboratory QA/QC program.
Scope of the program/Area/Region	Previously set up for site specific or industry specific monitoring.
Stakeholders	• Oil and Gas Industry • Landowners • Public • Municipalities
AIR MONITORING DIRECTIVE (AMD)	
Program Contacts	Interviewed • Gerry Lutwick • Chi Chen
History of Program	Initiated around solid sulphur handling facilities to monitor and manage the effects of deposition and oxidation of solid sulphur on soils. The AMD and soil monitoring portion were written in 1986. The program began with approximately 30 gas plants, and the numbers have been reduced over the years due to rationalization of assets in the industry. Program developed by Craig Palmer (AENV) who worked on the methods and sampling protocols, and Gerry Lutwick who developed the QA/QC program.
Description of Program	The purpose of program to provide assurance that industry is responding appropriately, and in a timely manner, to impact to soils from deposition of solid sulphur. The objectives include maintaining clean soil and protecting surface and groundwater. The program has similar principals as the SMD and contaminated sites programs (above), but specific to sulphur. If the program is required at a site, it is named in the site approval. The program consists of a monitoring program and report documenting the program and giving recommendations for amendment with limestone to amend acidic pH values. If the recommended liming program is not conducted, a deficiency letter is presented to industry.
Outcomes and Changes	To maintain clean soil and manage liability for clean-up on an ongoing basis while sour gas plants are in operation rather than at end of life. It is a successful program in achieving ongoing management of industrial impact, as liming programs are ongoing as deemed needed by the monitoring information. The AMD program is currently under review to evaluate, with respect to soil: • frequency of sampling; • risk based on soil sensitivity to acidification (based on location in the province and corollary soil conditions); • professional sign off; and • redundancy of the AENV QA/QC program given the certification program for professional laboratories.
Monitoring Information	Information is gathered by industry through completion of field programs, and summed up in reports sent to AENV. Hard copies of reports are kept in the file rooms of respective regional AENV offices, while the consulting company may have electronic copies of reports or data. The reports are public as they are required by approval conditions. Historically, the program is conducted at each gas plant on an annual basis, however, some approvals have been changed to allow a biennial or 1 in 3 years sampling basis. Annual sampling sites may have been classified to great group or greater detail. Soil data collected include: • pH; • cation exchange capacity; • bulk density;

REGULATORY RELATED PROGRAMS	
	• electrical conductivity; • sulphate sulphur; • total sulphur; • elemental sulphur (historical programs – discontinued); and • calcium carbonate equivalent.
Legislation/Policies/guidelines/criteria supported by the Programs	The AMD is in place under EPEA. It may have been initiated under the Clean Air Act. AENV developed the QA/QC program to evaluate labs' accuracy (requested by industry).
Scope of the program/Area/Region	Generally, sour gas plants are found on the west side of the province (sour gas fields). The program is divided into regional offices where reports are reviewed by AENV staff.
Stakeholders	• Industry • Regulators • Public (especially landowners who may be affected by sulphur drift)
RECLAMATION AND REMEDIATION FOR UPSTREAM OIL AND GAS SITES	
Program Contacts	Interviewed: • Darlene Howatt; • Arnold Janz; • Don Watson; http://www3.gov.ab.ca/env/protenf/landrec/upstream/index.html
History of Program	The first reclamation certificates were issued in the 1960s. At the time, reclamation was governed by the Surface Lands Act (1963), and the Mines and minerals Act. In 1971 the Department of Environment was created, and in 1973 reclamation fell under the Land Surface Reclamation Act and conservation of topsoil was the issue that drove changes in reclamation certification programs. In 1979, a 13 point reclamation guideline was developed by AENV which was very general, then in 1983, the equivalent land capability tools were developed. Between 1983 and 1993, reclamation standards and criteria were developed and several iterations were discussed with industry, with revised reclamation criteria in place in 1995. Up to 2003 SRD conducted audits, and AENV held enquiries based on complaints and site visits. After 2003, the process has changed to desktop review of reclamation certificate applications with some audits. The program is currently run by AENV under the EPEA, and SRD is responsible for files on public land (used to be Alberta Agriculture when public land was under that department).
Description of Program	Under EPEA, land in temporary use for resource extraction must be reclaimed to equivalent land capability. Equivalent land capability is described in the reclamation criteria through a series of parameters such as surface soil depth, admixing, stoniness, compaction and vegetation cover. The objective of the criteria is to describe allowable changes (based on consensus between government and industry). In 2003, the process of reclamation certification application was changed. Industry compiles a Phase I, and possibly Phase II, site information document which is submitted along with a reclamation certificate application. The documentation indicates any possible sources of contamination on the site, and any follow up work regarding those sources. As well, the application includes details of surface soil reclamation in the top 50 cm. AENV or SRD reviews the information and will follow up by random audits of approximately 15% of applications. Within AENV, audits are performed by regional land inspectors, and can be done for either surface reclamation or soil contamination. The remediation requirements of the program relate to control of pollution and the removal of contamination from land encumbrance. This has recently included a protocol for evaluating on-site disposal of drilling waste as a potential source of contamination. Under Alberta's Upstream Oil and Gas Reclamation and Remediation program industry maintains a 25-year liability period for surface reclamation issues (topography, vegetation, soil texture, drainage, etc.) and a lifetime liability for contamination. These liability periods are under review. Annual review of the program to determine performance measures and identify weaknesses in the application program. The annual review within the program has identified areas for research related to supporting the equivalency of reclamation criteria (e.g., depth of surface soil and impact from admixing), and has included a change to the investigation of drilling waste. The reclamation criteria advisory group is meeting to ensure that the 1995 well site reclamation criteria are sufficient and effective and review to see if there are problems. Internal program objectives include: • the ability to process applications year round due to increased capacity; • work on putting all end points under 1 document; and • provide an incentive for speedy reclamation after abandonment through connection to the lease liability rating of the EUB. Program statistics tracked include: • reclamation site assessment data; • professional sign off; • reclamation certificates issued and refused;

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REGULATORY RELATED PROGRAMS	
	• audit data; • abandoned vs. reclaimed site statistics; and • applications with acknowledgement of disclosure information form. http://www3.gov.ab.ca/env/soe/land_indicators/40_oilgas_reclamation.html Follow up monitoring to determine long term success of reclamation measures is not done. Green zone sites do not require reclamation to forest species, so productivity is not known at the time of reclamation certification. Long term evaluation of the effect of different levels of surface soil replacement, admixing, stoniness and compaction have not been monitored and evaluated against criteria.
Outcomes and Changes	The goals of the program are: • to be able to issue reclamation certificates; • for companies to meet conditions of the approval; and • to address complaints. The outcome of the program is to ensure that land is returned to equivalent land capability regardless of different activities. 10 recommendations were made by Oil and Gas Reclamation and Remediation Advisory Committee (OGRRAC) after review of the 2003 changes. These are being implemented. Very time consuming and expensive to set up a contaminant audit.
Monitoring Information	Information is gathered from industry through application for reclamation certificates and attached consultant's reports. A report would include the site evaluation of the top 50 cm of soil against reclamation criteria: • surface soil depth; • stoniness; • vegetation cover and density; • % admixing; and • topography. The Phase I report is a desk top review of file information, operator interviews and air photos. Based on the Phase I identification of sources of potential contamination, including drilling waste type and handling on the site, a Phase II investigation report may be included. This would contain: • soil pedological data; • depth to water table; • soil chemistry and texture data from specific boreholes; and • assessment of onsite contamination and a summary of the management of any contamination. Applications are received and logged in Edmonton, and reviewed in the regional offices. Statistical information is stored in an Environmental Management System database, but individual site data is not entered in a database. File data on a site is available through FOIP but there is no direct access as certain information is private. A copy of reclamation certificates can be obtained from the Environmental Law Centre.
Legislation/Policies/guidelines/criteria supported by the Programs	1993 EPEA Conservation and reclamation regulation - Criteria and standards were developed in the 1990s. EUB drilling waste document (1993) and link to AENV guide for investigating drilling waste disposal areas (2005). SRD is involved when reclamation certificates are issued for public lands. Incentive mechanism through the EUBs LLR process.
Scope of the program/Area/ Region	All province of Alberta – White zone, AENV, Green zone, SRD.
Stakeholders	• Developed with a number of stakeholders • Landowners • Government • EUB • SRD • CAPP • Industry • OGRRAC

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

REGULATORY RELATED PROGRAMS	
PETROLEUM STORAGE TANKS	
Program Contacts	Interviewed • Karen Gervais Additional contacts • Mike Zemanek • Joelle Hatton • Heather Von Hoff • Bob Lundsted
History of Program	The PST program was started in 1999-2000 by Environmental Assurance, Science and Standards Branch, in response to a backlog of open files in the department, relating to tank releases. The open files had been generated through a number of initiatives starting in 1991 with the initial guideline governing tanks, the Management of Underground Storage Tanks (MUST). The program is administered by AENV regional offices and uses approximately 4-5 FTE's for all 3 regions. Data collection, reporting and management are funded by industry.
Description of Program	The program is driven by complaints from the public and voluntary reporting by operators. Sites are prioritized with the highest priority given to those with groundwater impact from free product, or other obvious risk to human or environmental health. Operators need to meet EPEA requirements – duty to report and remediate releases to the environment. The program purpose is to accomplish the clean-up of contaminated sites, with a focus on soil, ground and surface water affected by tank releases. Data collection and management planning is done by a third party at the direction of the industry company. AENV evaluates the management strategy and asks for update reporting. There is no "sign off" on the site especially if a risk management approach is used in remediation.
Outcomes and Changes	Anticipated outcome is to have all PST sites cleaned up or remediated resulting in either closure of the file or to allow closure of the sites. Issues: • many long-term clean-ups, timeline is not quick, and program has required more resources for longer than anticipated; • result of risk management approach is often no closure; • enforcement tools are not always appropriate, for example, failure to remediate does not always lead in a straight line to an enforcement action; • don't have staff to manage the known sites; and • review by the Contaminated Site Project Committee is expected to help with prioritization of files, closures letters, audits, third party sign off.
Monitoring Information	Chemical data: • degree and extent of PHC contamination; • some metals; and • salts. QA/QC is found in the sampling and analytical programs, not institutionalized through AENV. Receptors include soil, groundwater, and surface water. Information is stored in regional offices; some is in archives, all information is now scanned to electronic files for eventual inclusion in web interface programs (ESAR). Most data is now routinely available to the public, however, there is a need to separate public from privileged information. The program statistics are evaluated quarterly, and performance measures include: • number of PSTs remediated, lifetime stats; • the number of PST sites in risk management; • Number of new sites; • Number of pending sites; and • Number of suspended sites. The program has been used to provide State of the environment (SOE) statistics, drive updates in criteria (2001), will influence the risk management policy, and may result in a Code of Practice being developed. http://www3.gov.ab.ca/env/soe/land_indicators/43_storage_tanks.html
Legislation/Policies/guidelines/criteria supported by the Programs	1993, EPEA governs reporting and remediation of releases to the environment. In 1991, the MUST guidelines developed reporting and management around underground storage tanks. In 1994, Remediation guidelines were put forward for PSTs. In 2001, Risk Management guidelines for PSTs were developed.

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REGULATORY RELATED PROGRAMS	
	Link to Municipal Affairs through the Safety codes Council Underground Tank Remediation program (2002)
Scope of the program/Area/Region	Covers all of Alberta. First Nations and federal land are separate.
Stakeholders	• Consultants • Industry • Realtors • Lawyers • Municipal planners • Development officers • Landowners • Media
CONSERVATION AND RECLAMATION C & R PLANS FOR PIPELINES	
Program Contacts	Interviewed • Don McCabe (AENV); http://www3.gov.ab.ca/env/protenf/landrec/index.html
History of Program	The formal program is for regulated pipelines (approximately 5% of pipelines), and does not cover unregulated pipelines. The program was started to provide some guidance for reclamation and conservation of soil, and has evolved with guidelines for soil handling and reclamation.
Description of Program	Proponent companies provide a conservation and reclamation plan for pipeline construction and reclamation on white zone land. The plan is submitted to a coordinator along with the application for the pipeline. Once the plan is accepted, there is no formal follow-up. Field inspections by AENV regional staff during and after construction are limited by resources in the regional offices. Inspections are largely driven by complaints from the public, which are handled through the regional offices. The AENV representative is currently co-chair of the Alberta Pipeline Environmental Steering Committee (APESC), which includes members from the Canadian Association of Petroleum Producers (CAPP), the National Energy Board (NEB), Alberta Sustainable Resources Department (ASRD), the Farmer's Advocate, landowner and surface rights activist groups, and others. This group has been proactive in dealing with pipeline environmental issues, but overall, the view of pipeline disturbance is that it is temporary, despite pipelines remaining in the ground after use. Industry does not see the usefulness of reclamation certificates, which are now the sign off mechanism for approved pipelines C&R plans, since the pipeline itself is not removed.
Outcomes and Changes	To assure that land is conserved and reclaimed on regulated pipeline projects. The objective includes assurance around watercourse crossings (governed by the Water Act). Still missing 95% of pipelines in the province. Greater coverage of pipelines may occur if the regulations move away from a reclamation certificate toward a Code of Practice for pipelines, which would bring Class II pipelines into the program.
Monitoring Information	Data includes: Landscape: • subsidence; and • drainage. Soils: • root zone (50 cm) quantity and quality; and • admixing. Vegetation: • density; • height; and • health. Companies submit 8 copies of paper files, which are stored in regional office of interest as well as with the Pipeline C and R coordinator. Information is public as it is associated with an approval, however landowner private information cannot be released. There is a new requirement (1 ½ years) to provide post construction reclamation assessment data, to provide AENV with some assessment of reclamation success. It is anticipated that there will be enough

REGULATORY RELATED PROGRAMS	
	data (50-55 pipeline assessments) within the next 2 years to be able to evaluate field effectiveness of C&R plans. From the evaluation, there is an opportunity to look for correlation between a change in construction or reclamation practice and changes in field condition, e.g., compaction.
Legislation/Policies/guidelines/criteria supported by the Programs	Started under the Land Surface Conservation Act (1981). Information requirements for regulated pipelines were developed in 1988. Is required under EPEA (1993) and the guide for pipeline development and reclamation approval was developed in 1995. The Water Act is also involved where pipelines cross water courses. Other jurisdictions involved include: the Energy and Utilities Board (EUB) which governs regulated pipelines and abandonment. ASRD which provides public land dispositions to pipelines in the green zone.
Scope of the program/Area/Region	White Zone is covered by the C&R plans, green zone exempt. Green zone requires land disposition and EUB license, but no AENV approval.
Stakeholders	• Landowners • AENV • ASRD • Alberta Agriculture, • NEB • EUB • APESC • CAPP • Farmer's Advocate • Surface Rights Groups • Class I and II Pipeline Companies • Municipalities.
NATURAL RESOURCES CONSERVATION BOARD (NRCB) – CONFINED FEEDING OPERATION APPLICATIONS	
Program Contacts	Interviewed • Jim Fujikawa (NRCB) http://www.nrcb.gov.ab.ca/cfomain/default.aspx
History of Program	The NRCB was established in 1991 under the Natural Resources Conservation Board Act. In 2002, it became responsible for regulating Alberta's confined feeding operations as a result of changes to the Agricultural Operation Practices Act. The NRCB reports to the Minister of Sustainable Resource Development. The NRCB mandate is to balance environmental, economic and public interest, but the mandate of Alberta Agriculture is to grow agricultural production. Hence, conflict has arisen over the differences in mandate between Alberta Agriculture and the NRCB.
Description of Program	Since CFOs are considered an agricultural practice, AENV does not get involved in the approval conditions. However, the NRCB would benefit by having standards of application for any contaminant situation, which could be used across industries. Contaminants of concern are nitrogen compounds and phosphorus. Approval conditions include loading rates for manure as a guide for operators. Limits on manure application are based on the EC value of the upper soil horizons, as a method of helping operators manage nutrient loading. There are no trigger points for the NRCB to initiate action related to soil data or actual loading rates. New work in Phosphorus loading may lead to further criteria. Ongoing monitoring by operators is not required, but manure application records can be audited by inspectors. A systematic review of records of manure application records was started but was curtailed due to a review of the NRCB mandate with regard to CFOs.
Outcomes and Changes	To set minimum criteria for startup of a CFO.
Monitoring Information	During an application the applicant must provide basic soils information on the top 60 cm of soil. • nitrate nitrogen; • electrical conductivity (EC), • sodium adsorption ratio, and • soil texture.
Legislation/Policies/guidelines/criteria supported by the Programs	Agricultural Operation Practices Act and regulations; Natural Resources Conservation Board Act.
Scope of the program/Area/Region	All of Alberta, but concentrated in Southern Alberta.

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REGULATORY RELATED PROGRAMS	
Stakeholders	• Alberta Agriculture • Landowners • CFO operators • Adjacent landowners • Groundwater users • Farmer's advocate • NRCB • AENV
MINING (COAL, SAND, GRAVEL, RECLAMATION, EIAs)	
Program Contacts	Interviewed • Chris Powter
History of Program	Oil, gas, coal and oil sand mining under Surface Reclamation Act Sand and gravel under Land Surface Conservation and Reclamation Act All replaced by EPEA
Description of Program	The legislation requires that the operators have to reclaim. The objective of the program is to document reclamation success and demonstrate to the public the progress industry is making to return land to equivalent land capability.
Outcomes and Changes	Current outcome of program –provides public with information on success of reclamation and applies some peer pressure within industry to encourage environmental stewardship. Has resulted in changes to how things are done. In future should monitor the progress of the programs and see if they are doing what they intend. Not enough information collected on the sand and gravel industry – could increase mandatory reporting. AENV should focus on showing reclamation success – keep track of the state of the environment on disturbed landscapes. Info that is available to the public and decision makers should be tracked at a more focused level than provincial – such as by watershed, municipality etc. Could do a survey to determine if info is useful for decision making and is it available in a timely manner.
Monitoring Information	Oil and gas – applications for reclamation certification are received, certificates are issued. Sand, gravel, coal and oil sands – monitor the area disturbed, reclaimed and certified – from that have the % disturbed, reclaimed and certified. Coal and oil sands prepare an annual report and sand and gravel prepare a 5 yr report as part of the code of practice requirements. State of the environment statistics are developed http://www3.gov.ab.ca/env/soe/land_indicators/41_oilsands_reclamation.html Information stored on paper copies in regional offices, data is extracted and put into database. Only regional staff has access to the reports however they could likely be obtained through FOIP. The data is publicly available on the website once it its collected and interpreted. No evaluation process.
Legislation/Policies/guidelines/criteria supported by the Programs	EPEA
Scope of the program/Area/Region	All of Alberta
Stakeholders	• Industry • EUB, environment • SRD, landowners • Consultants

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REGULATORY RELATED PROGRAMS	
PRAIRIE HYDROLOGY + RECLAMATION (PHRP) **DRILLING WASTE MANAGEMENT (DWM)**	
Program Contacts	Interviewed • Terry Macyk (ARC)
History of Program	PHRP 1979-95. Was prompted as TransAlta Utilities Camrose/Riley project was rejected as couldn't guarantee that reclamation could return land to equivalent land use – included groundwater, geology and soils. DWM 1985-93 Environment and Public lands had a concern that ID 75 was inadequate. Followed 1973 Land Conservation + Reclamation Act – issues had been raised on compaction, % surface soil, salinization, and differential settlement – created problems on agricultural land. Currently under EUB jurisdiction Both programs were developed jointly by AENV, RRTAC, ARC
Description of Program	PHRP concerned with loss of farm land – can agricultural land water supply and water quality be re-established DWM concerned with impact of drilling waste disposal on vegetation and soils –was the basis for the first G50 Had same vision as SREM –allow industry to develop without leaving a legacy of clean up
Outcomes and Changes	Return mined land to original land use (typically agricultural) Provided information on what can and can not be done with landscape– e.g. couldn't establish water wells as coal was the aquifer General Comments: Insufficient long term monitoring – don't know if sustainable development has been achieved without long term monitoring. Unsure what is definition of success Don't always utilize data we have – should interpret what we have before collecting more
Monitoring Information	PHRP – geology, hydrogeology, soil properties, biomass DW – liquid + solid phases, soil, veg growth For both programs – data obtained through field work; unsure where data stored; mostly paper copies; was used to develop manuals + guidelines; data was available by request QA/AC was conducted on the lab data – there was extensive review and discussion of the RRTAC manuals and G50
Legislation/Policies/guidelines/criteria supported by the Programs	PHRP - na DWM – G50
Scope of the program/Area/Region	PHRP covered agricultural land DWM covered all of province
Stakeholders	• EUB • Environment • SRD • GoA • Landowners • Crown • General public

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

REGULATORY RELATED PROGRAMS	
ENVIRONMENTAL IMPACT ASSESSMENTS (EIAS)	
Program Contacts	Interviewed • Taras Pojosak (AENV), • Phil Ullman (Matrix)
History of Program	The first EIA conducted in Alberta was for Kananaskis Provincial park in the 1970s. In the 1970s, proponents of development were required to do an EIA if the Minister of Environment deemed it necessary. The formal guidelines for EIAs were published in 1977, and were driven by environmental approvals required under the Clean Air Act, the Clean Water Act and the Land Surface Conservation and Reclamation Act. Further changes to the process were triggered in the 1980s after the Federal government environmental impact assessment of dams on waterways in Alberta and Saskatchewan. In 1993, EPEA was enacted and EIAs were identified as required for regulated developments, at the discretion of the Director. A schedule of regulated activities was developed. The level of sophistication in EIA data collection and process has steadily increased. A typical EIA includes gathering data on surface water, wildlife, terrain and soils, vegetation including rare plants, air dispersion modeling, historical and cultural resources, social and economic impacts.
Description of Program	Information related to the environment, including soils and terrain, which is collected to support an application for a regulated industrial development. The information is collected before the application is made, and represents the baseline condition of the area under development. Impact assessment from the individual development and cumulative effects assessment are also included in the EIA. Soil and terrain information is utilized to plan development to minimize the impact to soil. Conservation and reclamation plans are developed. Increasing attention is being directed during to the EIA process to loss of landforms, such as wetlands, which are generally reclaimed to uplands or waterbodies.
Outcomes and Changes	Ensure that information is available to guide reclamation activities. Commitment in the EIA to long term regional monitoring for soil acidification trends. Opportunities: Potential for partnership with airshed groups, e.g., Fort Air partnership program may have some soil monitoring and many government agencies are active in Fort McMurray but nothing tying it together – one database or process to tie it together would be useful. Expand background information from AMD program and EIAs to determine the potential effect from acid deposition.
Monitoring Information	Soil data from inspections, at a density of one inspection per 2 to 5 hectares, which fulfills a level I soil survey, on the proposed development area. Soils are classified according to the Canadian System of Soil Classification, terrain is mapped from air photos and field investigation, and vegetative cover information is converted to ecological land classification. Soil chemical data is collected to be used in four evaluations: • reclamation potential; • productivity potential (forestry or agriculture); • acidification potential; and • erosion potential. Soil data collected include the following parameters and possibly more: • pH; • EC; • SAR; • exchangeable cations; • soil texture; and • cation exchange capacity. Soil data is held electronically in consultants' offices and submitted in paper (or CD) version. Estimates of impacts account for soil handling methodologies during development. Cumulative impacts utilize data from all anticipated projects in the area.
Legislation/Policies/guidelines/criteria supported by the Programs	EPEA; regulated activities are set out under EPEA.
Scope of the program/Area/Region	Province wide for regulated activities.
Stakeholders	Landowners, industry, government departments including EUB, traditional land users.

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

REGULATORY RELATED PROGRAMS	
TERRESTRIAL ENVIRONMENTAL EFFECTS MONITORING (TEEM)	
Program Contacts	Interviewed • Randal Barrett, Additional Contacts • Martina Krieger (AENV), • Kim Sing (WBEA); http://www.wbea.org/lm/default.aspx
History of Program	A monitoring program in the Athabasca Oilsands area, developed by the Wood Buffalo Environmental Association (WBEA) in 1995. It was established to coordinate monitoring activities previously conducted separately by Syncrude and Suncor. The WBEA is a large multi-stakeholder organization which coordinates research required by member companies through the approvals process. It provides a mechanism for coordination of research funding and initiatives, stakeholder review of the monitoring program, and funding
Description of Program	The program mandate is to carry out long term monitoring to characterize and quantify impact from air emissions of acidic, nitrogen or metal compounds on terrestrial ecosystems and traditional resources. Multi-stakeholders group including Syncrude, Suncor, AENV, EUB and scientific experts from the University of Alberta and international academics. Work is done in a group effort to support approval conditions of industry members, and the estimated resources are $500,000 per year. If trends in impact from acid deposition are identified, the information triggers the acid deposition framework model to determine cause of the trend.
Outcomes and Changes	No measurable negative impact on the environment due to deposition (support of CASA outcome) of acid, nitrogen and metal emissions. New parameters are being brought forward – e.g., eutrophication. Bogs and fens have been identified as more sensitive indicators than anticipated.
Monitoring Information	Plots have focused on apsen and lodgepole pine sites in the past, but there is a shift to monitoring lodgepole pine and bog and fen sites, as organic sites are considered most at risk from acidic deposition. Monitor sulphur dioxide (SO_2), nitrogen dioxide (NO_2), soil chemistry, vegetation samples, and use false infrared pictures. Data is collected by consultants and academics, and program is coordinated by the TEEM program manager. The program includes annual sampling of some sites in a rotation of all of the sites. Data is stored by WBEA, is available on the website to members, and summary reports are available to the public. QA/QC through system reviews.
Legislation/Policies/guidelines/criteria supported by the Programs	EPEA (1993), Energy Conservation Act, Regional Sustainability Development Framework, Acid Deposition Framework
Scope of the program / Area / Region /	Covers northeast Alberta in the Athabasca Oilsands region.
Stakeholders	Stakeholders are members, industry, Alberta government, Health Authority, EUB, First Nations and Metis representatives, regional municipality.
SOIL AND VEGETATION WORKING GROUP OF THE CUMULATIVE ENVIRONMENTAL MANAGEMENT ASSOCIATION (CEMA)	
Program Contacts	Interviewed • Chi Chen
History of Program	CEMA is a multi-stakeholder association, started in the 1990's, including major oilsands companies, First Nations Representatives, AENV, ASRD, and the EUB. The soil and vegetation working group is one of several subgroups under the reclamation working group. The soil and vegetation group is tasked with research in: reclamation management; land capability assessment; revegetation; and, acid deposition.
Description of Program	CEMA membership and participation is linked to the approval process for new oilsands operators. Decisions are taken on a consensus basis. CEMA has a project manager for the research projects. The effort and input of industry members is aimed at fulfilling approval conditions. External evaluation by experts is requested by CEMA at times and is provided by the academic and consulting fraternities.
Outcomes and Changes	Establishing conditions that provide equivalent land capability – productivity of forests. Keep the integrity of natural system. Industrial focus to reduce footprint, fulfill approvals. Outcomes are driven by the needs of the members.
Monitoring Information	45 to 49 plots established on natural and reclaimed landscapes, to monitor acid deposition, and establish how well land capability calibration predicts response to acidic deposition. New plots are established yearly, one plot for every 100 hectares of reclaimed land. Chemical and physical data are collected for soil at each site, including pedological description. Vegetation information includes changes in production,

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

REGULATORY RELATED PROGRAMS	
	species composition, and succession. Sites are sampled on a 5 year rotation by third party consultants. The database for collected data was developed in 2003 / 2004. Reports and data are available to members and are received and reviewed by the regional AENV office.
Legislation/Policies/guidelines/criteria supported by the Programs	EPEA; Acid Depostion Management Framework for the Oilsands Region of North-Eastern Alberta
Scope of the program / Area / Region /	Northeast Alberta Oilsands Development Area
Stakeholders	
MINING (SYNCRUDE RESEARCH)	
Program Contacts	Interviewed • Clara Qualizza, (Syncrude)
History of Program	The program is called the Syncrude Instrumented Watershed Research program was developed by Syncrude and the University of Saskatchewan on the Syncrude facility. It was begun in 1999 in addition to other approval related research Syncrude participates in through TEEM and CEMA. Funded by Syncrude to fulfill an approval condition to conduct research, it provides for greater detail and extent than required by the approval. The aim is to provide quality data to support operational level recommendations that guide materials handling and reclamation.
Description of Program	The objective is to design reclaimed watersheds to optimize the cycles to recreate a sustainable boreal landscape. This program consists of long term research projects consisting of reclaimed watershed monitoring on various soil types: saline sodic overburden, tailing sand, coke, lean oil sand, and sulphur. The capital cost of the monitoring program is $2.5 to 3 million with an additional annual operating budget of $250,000. The non-automated program components rely on unpaid student labour input equivalent to approximately 7.5 full time employees. At the end of six years of research, there is enough data to initiate a technology transfer process to transfer learnings to the operations group, through clear recommendations given to management. The first iteration of this process is in place for 2006. The program is moving toward comparing and contrasting oilsands watershed reconstruction to other mine reconstructions.
Outcomes and Changes	Publication of research results. Fulfill approval conditions for research. Provide clear recommendations for operation personnel to optimize reclamation. Provide a clear indication of what is sufficient monitoring to evaluate watershed sustainability.
Monitoring Information	Monitoring is designed to determine water and energy balances in the watershed, the fate of salts in the system, ecological responses to water and salt cycles, and design of watershed to optimize cycles and recreate a sustainable boreal forest. Data are divided between a database capture from automated monitoring equipment that monitors water movement and water quality, and student theses reports. Data are accessible to Syncrude personnel, researchers, and would be given to AENV if requested. Student research theses are framed by the individual researcher and are the intellectual property of the student. The monitoring is an ongoing annual program with 6 years of data.
Legislation/Policies/guidelines/criteria supported by the Programs	
Scope of the program/Area/Region	The stakeholders are the research community, and industry partners. The program only covers areas where Syncrude is active.
Stakeholders	

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

REGULATORY RELATED PROGRAMS	
RANGELAND REFERENCE AREA PROGRAM	
Program Contacts	Interviewed • Michael Willoughby (SRD), • Gerry Ehlert (SRD) http://www3.gov.ab.ca/srd/land/rm_rm_monitoring.html
History of Program	Monitoring plots date back to 1950's Began under Public Lands Act and Forest Reserve Act as it relates to livestock grazing, grazing dispositions and management Originally divided between AENV and Alberta Ag., now all under SRD
Description of Program	Data are collected (detailed range community surveys, Rangeland Reference Area Monitoring Program and Research projects) The data are stored and analysed using the Ecological Rangeland Database. Tools are created with this data such as carrying capacity and plant community guides, reports, research papers, GIS base maps and health tools. From these tools, extension courses are developed. As well the database is used to prepare Rangeland Integration Plans and Special Projects. The tools that are created are used by the public land specialists for disposition management and compliance. They are also used by the Range Management Specialists to develop policy, coordinate programs and can be used by other rangeland users (wildlife, recreation, timber).
Outcomes and Changes	The primary goal of public land range management in the province is to deliver an integrated strategy involving range and land management that achieves and maintains the public land base under acceptable or greater standard of stewardship based on range and riparian health. Partnership opportunities with the biodiversity index that is being developed and with universities to supply expertise. Can't do business without partnership as monitoring is expensive. Need to have partnerships to share cost of data collection, data maintenance, analysis, storage. More skill development will be required in the future – e.g. insect and plant taxonomists. Value in partnerships as they could bring in expertise. Currently have a number of partnerships with Cows and Fish and water groups that partner with the forest industry to monitor timber.
Monitoring Information	Data includes vegetation, soils, production - field collection by SRD Electronic files kept in house, not public information -used in reports, guidelines, on website Reference areas read every 3 years
Legislation/Policies/guidelines/criteria supported by the Programs	Public Lands Act
Scope of the program/Area/Region	Covers areas all over Alberta, mainly in livestock areas
Stakeholders	• Rangeland resource users • Recreational users • Rangeland managers • Wildlife managers • Forestry

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

NON-REGULATORY RELATED PROGRAMS	
LONG TERM SOIL ACIDIFICATION MONITORING PROGRAM	
Program Contacts	Interviewed • Gordon Dinwoodie, • Gerry Lutwick
History of Program	Developed in 1980 – '81 by the Soil Protection Branch (Henry Regier) with input from the Alberta Research Council (ARC). The program was prompted by concern in the 1970s about acid deposition impacts to soil and surface water. The program is now administered by the Monitoring and Evaluation Branch and funded by AENV Land Monitoring Team. Funding was reduced so fewer samples are analyzed per site and fewer analytical parameters are analyzed per sample.
Description of Program	The purpose is to determine if acidic emissions affect soil quality, to look for changes in soil data, and determine trends related to soil acidification. The program is currently linked to groups like Cumulative Environmental Management Association (CEMA), Clean Air Strategic Alliance (CASA), and Terrestrial Environmental Effects Monitoring (TEEM). AENV established a new site with TEEM, with air, rain, water, soil and vegetation monitoring. The program is a voluntary, internal AENV program, with no trigger for AENV to act. Reports and analysis of the data are minimal, a summary report is in preparation. 8 sites were established based on sensitivity to soil acidification (i.e., coarse-grained soil, non-calcarerous soil), downwind of a source of acidic emissions. Requires about $40,000 per year.
Outcomes and Changes	Provides an early warning of adverse effects of acid deposition; long term data collection which reduces the impact from annual variability. Now have 25 years of data, enough to begin to draw conclusions and trend analysis. May drop southern plot due to lack of impact.
Monitoring Information	Soil from eight sites are monitored for: • cations; • pH; • sulphate sulphur; • chloride; and • electrical conductivity. With enough data, the following indicators will be of use in trend analysis: • calcium/aluminum ratio; • pH; and • base saturation trends. Data are collected from each plot every 4 years, through the annual sampling of two plots, in rotation. AENV either collects its own data or contracts the work out, and ARC does the analytical work. There is a lab QA/QC program. Data are stored electronically at the Monitoring and Evaluation Branch. AENV, ARC has access to data; public could request data. No trigger indicator and level has been established to influence decisions. Good partnership opportunities with CASA, CEMA, particularly in developing triggers. The program could be improved with air monitoring at all sites.
Legislation/Policies/guidelines/criteria supported by the Programs	None directly.

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

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Legislation/Policies/guidelines/criteria supported by the Programs	Public Lands Act
Scope of the program/Area/Region	Covers areas all over Alberta, mainly in livestock areas
Stakeholders	• Rangeland resource users • Recreational users • Rangeland managers • Wildlife managers • Forestry

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

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Legislation/Policies/guidelines/criteria supported by the Programs	None directly.

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

NON-REGULATORY RELATED PROGRAMS	
Scope of the program/Area/Region	Covers the parts of the province with soils susceptible to acidic deposition (other than the southeast quarter of the province) Sites at • Twin Butte • Esther • Bruderheim • Devon • Rocky Mountain House • High Prairie • Fort McMurray • Cold Lake
Stakeholders	• AENV • ARC • public • CASA • industry • TEEM • airshed groups
PESTICIDES (SALES INVENTORY)	
Program Contacts	Interviewed • Gary Byrtus
History of Program	Program developed by Pesticide Management Branch (Gary Byrtus, Janet McLean) - Internally funded Started in 1991 as a query for agricultural use of pesticides. CAESA initiated a report in 1993 for supporting water quality monitoring priorities. 1998 and 2003 surveys with broader scope, includes domestic, commercial, and other use sectors Major sales survey planned for 2008
Description of Program	Purpose is to provide a comprehensive overview of pesticide sales in Alberta every 5 years Information is used for a wide range of programs, i.e. water quality monitoring, pesticide management etc. Requirement to supply sales and use records in legislation This provides an information component to develop policies to achieve outcomes of Water for Life Voluntary program for AENV but non-compliance for a vendor not to submit records AESA (Alberta Environmentally Sustainable Agriculture) and City of Calgary have requested data for their monitoring programs
Outcomes and Changes	Anticipated outcome is to have a comprehensive picture of pesticide use based on sales Some shortcomings in linking sales to use, spatial distributions, and comprehensiveness of data Domestic sales of weed and feed fertilizers was higher than expected in 1998, has become a focus for urban pesticide management Discussion of a National Pesticide Sales Database
Monitoring Information	Information is obtained by letter of request to pesticide distributors and retail outlets, received in paper and electronic formats Data stored electronically in database, considered to be confidential business information Data used for fact sheets and as an SOE indicator. http://www3.gov.ab.ca/env/soe/land_indicators/36_pesticide_use.html Major survey done every 5 years, annual survey for domestic sales and urban pesticide use between 2003 and 2008
Legislation/Policies/guidelines/criteria supported by the Programs	Data requested under authority of Pesticide (Ministerial) Regulation
Scope of the program/Area/Region	Most parts of the province where pesticides are used – some remote usage is not addressed (e.g. forestry RoW) as there are only one or two vendors for this sector

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

NON-REGULATORY RELATED PROGRAMS	
Stakeholders	• Croplife certified warehouses. • Wholesale and retail suppliers. • AAFRD. • Major cities • Potential stakeholders are Watershed Protection Advisory Councils (WPACs)
SOIL METALS (HISTORICAL)	
Program Contacts	Interviewed • Gerry Lutwick
History of Program	The two historical programs included sampling and analysis of biosolids in support of municipalities and their waste management programs (15 years of data between the 1970s and 1990s), and ambient soil metal data from soil under different uses, such as transportation corridors or residential (approximately 5 – 10 years of data collected between the late 1980s and early 1990s)
Description of Program	Municipal governments were required to meet the Guidelines for Biosolid Spreading, and AENV supported this work through sampling and analytical work. The guidelines set out loading rates for metals and the sampling and analysis identified naturally occurring levels of metals as well as metal levels after spreading. The ambient metals program was instigated to determine if metals concentration in soils differed according changes in land use
Outcomes and Changes	Generate information to link metals concentrations to a wide range of soil conditions.
Monitoring Information	The biosolids metal sampling program included approximately 12 municipalities per year for approximately 15 years. The ambient program included annual sampling for four years. A database of the metals information has been compiled and is available from AENV on request
Legislation/Policies/guidelines/criteria supported by the Programs	Guideline for Biosolid Spreading
Scope of the program/Area/Region	The biosolids program was conducted in municipalities south of Athabasca, Alberta. The focus of the ambient program was major highways, all located south of or at Edmonton.
Stakeholders	
SOIL METALS (CURRENT)	
Program Contacts	Interviewed • Gary Byrtus
History of Program	A new initiative began in 2004 as an AENV research project initiated in response to a lack of data on surficial soil metals for assessment of water quality, and is still under development. The database of historical metals information is available to the new initiative. Initial funding from AENV
Description of Program	The purpose is to provide a compilation of background soil metals data for Alberta to enable spatial assessments and determine how representative baseline/background assessments are in soil monitoring projects. Goal is to provide background metals data for watershed and water quality assessment, soil metals spatial variability and distribution of the data through online access. Will aid in identifying areas of the province where metals naturally exceed guidelines. Voluntary program. No triggers identified yet.
Outcomes and Changes	Envisioned outcome is a spatially diverse, comprehensive database of soil metal data for Alberta – could be used to influence policy and guideline development around soil metals. Issues with AE priorities – should resources be spent on collecting background info?
Monitoring Information	Initial data from AENV reports, literature, and Komex database. Future data may come from AENV soil monitoring reports and industry through more consulting firms. Data stored on network drive, limited access to AE staff. Future data access may come through electronic reporting format based on requests from AE or as part of monitoring conditions.

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

NON-REGULATORY RELATED PROGRAMS	
	Program could be strengthened by partnership with other agencies
Legislation/Policies/guidelines/criteria supported by the Programs	Not at this time.
Scope of the program/Area/Region	All of Alberta is included in the scope.
Stakeholders	• AENV; • Alberta Geological Survey; • consultants; • WPACs; • PFRA; etc.
TURTLE MOUNTAIN GEOLOGICAL MONITORING	
Program Contacts	Interviewed • Gary Byrtus Additional Contacts • Earth Sciences/ Doug Bingham – retired; • Alberta Geological Survey http://www.ags.gov.ab.ca/activities/Turtle_Mountain/mainpage.htm
History of Program	Mountain monitoring was prompted by the Frank Slide in 1903. Alberta Geological Survey initiated monitoring in 1930's with a relatively crude system. AENV (Earth Sciences) was involved from 1980 to 1995, when a new program was initiated in response to renewed concern over stability of Turtle Mountain. State of the art predictive monitoring is now in place, as technology has improved from crude measurements of fissure expansion to high accuracy, continuous monitoring with real time data transfer via telemetry. AGS (EUB) again took over the monitoring role in 2003 (100th Anniversary of Frank Slide) and the budget is managed by that group.
Description of Program	Voluntary, in that there is no regulatory requirement for the Government of Alberta to conduct this monitoring, but it falls under the role of public protection. The system is designed to provide early warning of slope instability of Turtle Mountain. Slope instability is tied to land use and land development issues in shadow of Turtle Mountain.
Outcomes and Changes	Information to provide warning of slope instability on Turtle Mountain, and thereby protect the public.
Monitoring Information	Geological information from tiltmeters, crackmeters, laser ranging devices, aerial photogrammetry, seismic monitoring, outflow from springs, rock temperature, and weather data are collected from numerous installations on the mountain. Onsite data is transmitted from data loggers through remote telemetry to the Frank Slide Interpretive Centre, where it is then transferred to AGS in Edmonton. The current information is in digital format. Information has been used to develop four protocols of a warning system: • monitoring and data review; • threshold development; • alert levels and notification protocols; and • Emergency Response Planning.
Legislation/Policies/guidelines/criteria supported by the Programs	None
Scope of the program/Area/Region	Turtle mountain area.
Stakeholders	• AGS • MD of Crowsnest Pass • CP Rail • Infrastructure and Transportation

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ALBERTA ENVIRONMENT LAND MONITORING PROGRAM INVENTORY

FUTURE ORIENTED PROGRAMS	
ALBERTA BIODIVERSITY MONITORING PROGRAM (ABMP)	
Program Contacts	Interviewed • Kirk Andries (ABMP); • Brad Stelfox (independent consultant) • http://www.abmp.arc.ab.ca/
History of Program	ABMP was begun in 1998, and took 4 ½ years to devise the methodologies to satisfy the scientific community. The program was initiated after a gap was identified in resource management information. The program is in the fourth year of a four year test phase, which will end in spring 2007. The current program focus is to operationalize the prototype on a provincial scale in 2007 and to secure long term funding through capitalization of the program. In the future, this is anticipated to be a not for profit group, with membership and a board of directors, a chief executive officer and about 6 full time employees.
Description of Program	The program was developed by academics, government and industry representatives, who developed the methodologies for biodiversity monitoring in Alberta. The program consists of 1659 sites located on a 20 km grid pattern throughout the province. It would require $10 million per year to operate, and would involve monitoring 1/5th of the sites annually in random rotation. There is the possibility of linking to the National Forest Inventory (NFI) which also has sites on a 20 km grid. The ABMP does not now have land or soil indicators but is looking at the soil protocol of the NFI, and is developing landscape indicators. Biodiversity assessments are required in EIA work, but have no clear champion within the government, and no clear link to provincial assessment of conditions. The program can deliver information on biodiversity conditions and trends with about 11 years of data (three data points for any one site). Only with sustained monitoring can scientific community determine the range of natural variation. Once the range is established, then the edges of the range represent the risk to the indicator can be managed according to society's level of acceptable risk.
Outcomes and Changes	High quality, current and accessible information that is useful to resource management.
Monitoring Information	Program data include field collected data and remote sensing data. Each site would require 4 to 5 visits in the year of sampling. The results of biodiversity data collection can be reported in a biodiversity index number. A data management system is in place, pioneered at the University of Alberta. The intent is to merge the database with a customer interface such as website access. Data will be used to create information products. The data could support regional initiatives on the scale of a water basin, as it requires a minimum of 40 data points for statistically relevant results. Smaller regional initiatives, such as watersheds, might have to augment the data collection by increase in density of sampling.
Legislation/Policies/guidelines/criteria supported by the Programs	None
Scope of the program/Area/Region	Province wide
Stakeholders	• Academics • Industry • Government • ABMP • Regional Partnerships and Initiatives

APPENDIX C3

DETAILED PROGRAM OUTCOMES LINKED TO MID LEVEL AND HIGH LEVEL OUTCOMES ESTABLISHED BY THE GOVERNMENT OF ALBERTA

APPENDIX C3

DETAILED PROGRAM OUTCOMES LINKED TO MID LEVEL AND HIGH LEVEL OUTCOMES ESTABLISHED BY GOVERNMENT OF ALBERTA

AENV Monitoring Program	Outcomes of the Program Detailed , Short Term Level	Link to Mid Term Land Monitoring Outcome	Link to High Level, Broad Outcomes and Strategies	
			Broad Outcome[1]	Strategies Where Broad Outcome is Found
Soil Management Program; Air Monitoring Directive Soil Monitoring; Petroleum Storage Tank (PST) Program	• Provide effective criteria on which to judge impact from a release and evaluate management options. • Encourage proactive management toward remediation and reclamation of soil after a release from an industrial facility. Proactive soil remediation limits liability for the company and public, as remediation occurs during the life of the asset. • Ensure that soil will meet equivalent land capability after industrial use (does not apply to PST program). • Anticipated outcome is to have all PST sites cleaned up or remediated resulting in either closure of the file or to allow closure of the sites.	Land monitoring programs assure that AENV's regulatory responsibilities are met. Pollution is controlled above, at or below the surface in the drilling of wells and in operations for the production of oil and gas and in other operations (Oil and Gas Conservation Act) Pollution is controlled and the environment is conserved in the development of the coal resources of Alberta (Coal Conservation Act) Pollution is controlled in the development and production of the oil sands resources of Alberta (Oil Sands Conservation Act)	1. Alberta's environment is clean and safe. • Environmental risks are managed and a rapid and coordinated response to environmental emergencies is ensured. 2. The maintenance and enhancement of a healthy natural environment is contributed to. 3. Fulfill approval conditions and duty to report and remediate releases to the environment. 4. Our vision encompasses all of the following elements. • The quality of air, water and land is assured... 5. The Government is a responsible steward of the province's natural resources. 6. Pollution is controlled and the environment is conserved in the exploration for, processing, developing and transportation of energy resources.	1. AENV Business Plan 2. Land use Policies 3. EPEA 4. Commitment to Sustainable Resource and Environmental Management 5. Government of Alberta Strategic plan 6. Energy Resources Conservation Board
Reclamation and Remediation (Upstream oil and gas; Mining (sand and gravel; coal; Oilsands); Pipelines)	• Identify and promote soil handling practices during and after construction that enhance reclamation success. • To assure that land is conserved and reclaimed on regulated pipeline projects. The objective includes assurance around watercourse crossings (governed by the Water Act) • To assure land released from temporary industrial use is returned to an equivalent land capability. Soil resources are maintained in a state equivalent to adjacent undisturbed soil. • Defining the endpoint through development of criteria and standards. • Mining reclamation research has provided information on what can and can not be done with landscape. • To provide public with information on success of reclamation. • Program evaluation outcomes include increasing successful applications for reclamation certificates. • Provide clear recommendations for operation personnel to optimize reclamation. • Provide clear indication of what is sufficient monitoring to evaluate watershed sustainability.	Land monitoring programs assure that AENV's regulatory responsibilities are met. Land monitoring programs assure that AENV is able to measure performance in achieving defined outcomes for environmental management. Pollution is controlled above, at or below the surface in the drilling of wells and in operations for the production of oil and gas and in other operations (Oil and Gas Conservation Act) Pollutions is controlled and the environment is conserved in the development of the coal resources of Alberta (Coal Conservation Act) Pollution is controlled in the development and production of the oil sands resources of Alberta (Oil Sands Conservation Act)	1. The maintenance and enhancement of a healthy natural environment is contributed to. 2. Fulfill approval conditions and duty to report and remediate releases to the environment. 3. Our vision encompasses all of the following elements. • The quality of air, water and land is assured... 4. The Government is a responsible steward of the province's natural resources.	1. Land use Policies 2. EPEA 3. Commitment to Sustainable Resource and Environmental Management 4. Government of Alberta Strategic plan

APPENDIX C3

DETAILED PROGRAM OUTCOMES LINKED TO MID LEVEL AND HIGH LEVEL OUTCOMES ESTABLISHED BY GOVERNMENT OF ALBERTA

AENV Monitoring Program	Outcomes of the Program Detailed , Short Term Level	Link to Mid Term Land Monitoring Outcome	Link to High Level, Broad Outcomes and Strategies	
			Broad Outcome[1]	Strategies Where Broad Outcome is Found
Acid Deposition (Long term acidification plots; TEEM; CEMA soil and vegetation working group)	• Provides an early warning of adverse effects of acid deposition; long term data collection which reduces the effect • No measurable negative impact on the environment due to deposition (support of CASA outcome) of acid, nitrogen and metal emissions	Land monitoring programs assure that AENV's regulatory responsibilities are met. Land monitoring programs assure that AENV is able to measure performance in achieving defined outcomes for environmental management.	1. The high quality of Alberta's environment is sustained. 2. The management approach for all point-source emissions in Alberta is strengthened in order to avoid adverse effects on human health and the environment. 3. The environmental threshold of critical loads for acid deposition across Canada is met.	1. Government of Alberta Business Plan 2. Clean Air Strategic Alliance 3. The Canada-Wide Acid Rain Strategy
Pesticides Sales Inventory	• Anticipated outcome is to have a comprehensive spatial representation of pesticide use based on sales (limitations of the data linking sales to use and spatial distribution).	Land monitoring provides accurate and timely information to support SREM; our partners' decision making is guided by quality land monitoring information. River Water Quality Index (evaluates river water quality related to metals, bacteria, nutrients and pesticides)	Developing water management objectives and priorities for watershed plans to sustain aquatic ecosystems, and enable sustainable economic development.	1. AENV Business Plan
Soil Metals	• Envisioned outcome was a comprehensive, spatial database of soil metal data for Alberta.	Land monitoring provides accurate and timely information to support SREM; our partners' decision making is guided by quality land monitoring information. River Water Quality Index (evaluates river water quality related to metals, bacteria, nutrients and pesticides)	Developing water management objectives and priorities for watershed plans to sustain aquatic ecosystems, and enable sustainable economic development.	1. AENV Business Plan
Rangeland reference area program (SRD)	• To monitor grazing sustainability and drive management practices	Sustainable use of public land and resources (Integrated Land management Program (DRAFT))	1. The value Albertans receive from rangelands are sustained and enhanced for future generations.	1. ASRD Business Plan
Environmental Impact Assessments (NRCB – Confined Feeding Operations, no-energy resource development; EUB regulated energy and utilities facilities)	• To determine baseline soils and terrain conditions prior to development. • To guide appropriate soil handling during development and reclamation. • To meet minimum criteria for startup under Approval conditions. • To contribute to the evaluation of cumulative effects on soils and terrain.	Land monitoring programs assure that AENV's regulatory responsibilities are met. Growth scenarios in agriculture - potential opportunity for 500,000 additional import feeder beef cattle into feedlots (50% increase) by 2010 (Ag Growth Strategy)	1. Clear and detailed messages or direction for the public, industry and government as to how Alberta's resources are to be managed and protected: • The use of Alberta's natural resources shall be sustainable; • Alberta's environment shall be protected. 2. Natural resource development projects and confined feeding operations respect the balance of social, economic and environmental interests of Albertans. 3. Pollution is controlled and the environment is conserved in the exploration for, processing, developing and transportation of energy resources. 4. The environmental effects of proposed projects are carefully considered before decisions are taken by governments.	1. Commitment to Sustainable Resource and Environmental Management 2. SRD Business Plan 3. Energy Resources Conservation Act 4. CCME Accord on Environmental Harmony, Environmental Assessment sub-Agreement

[1] Excerpted from the Draft Report "Sustainable Resource and Environmental management; An Inventory of Provincial Outcome Statements," prepared by Kim Lalonde for Alberta Environment, November 2005. Not in circulation.

APPENDIX D

INTERVIEW AND SURVEY RESPONSES ON FUTURE NEEDS AND OPPORTUNITIES

APPENDIX D

INTERVIEW AND SURVEY RESPONSES ON FUTURE NEEDS AND OPPORTUNITIES JANUARY 2006

Following sections report the notes taken during the interviews and the responses given by survey respondents with respect to specific future oriented components of land monitoring.

1.0 FUTURE FOCUS FOR ALBERTA ENVIRONMENT LAND MONITORING PROGRAMS

1.1 Land issue identification

- What is the bigger "question"?
- Land is a resource with public value.
- Determine the issues of importance and the indicators of land quality for that issue.
- Evaluate the issues – is acid deposition in the oil sands area the most pressing issue? Fragmentation in the green zone? Fragmentation in the white zone? Footprint modeling?
- Develop an inventory system for priority land use and land quality issues:
  - develop or implement thresholds/criteria/guidelines for measuring against the land use and land quality issues; and
  - develop systems to monitor and measure ecological, economic and social effects related to priority land use and quality issue.

1.2 Management and Sustainable Resource and Environmental Management (SREM)

- Coordinated monitoring toward common goals.
- Land monitoring information could support economic decision through incentive programs.
- Put more effort into up front planning, so that monitoring helps with land management decisions.
- Define the broader goal before the monitoring program, look at how many potential stakeholders or partners have a stake in the goal and look at multiple partnerships or alliances.
- Create an overarching goal that can be defined and delivered on a local basis, rather than focusing locally and searching for a goal.
- Cross ministry work – focus for aligning outcomes, vision, data collection, support system, process – land use framework.

- Determine how integrated management would work then work with the other partners to build monitoring program.

- Alberta Environment (AENV) needs to pull together the multiple programs for air, water, land and bring together evaluation.

1.3 Establishing the condition of the land and effectively reporting on it

- What is the state or condition of land? What kinds of information do we need to answer the questions we are asking?

- Cumulative effects – need a level of information to provide understanding of state of the environment.

- How often do you need to reevaluate the state? Then, so what – what are the limits of tolerance, what is the trend, action? What are the tipping points in the natural world?

- State of the Environment (SOE) reporting and framework of indicators/condition. Needs information on:

  - land use and land quality trends;
  - determine the values attached to land and indicators of that value – regional basis;
  - sensitivity of land to development – regional. Link to value of land;
  - determine the impacts or cause and effects of development; and
  - establish stewardship metrics.

- Apply a more holistic approach, starting with state or condition of the environment, look at monitoring of industrial facilities within the broad view. Reporting of industry successes/failures.

- Develop the mechanism to be able to determine the state of the environment in the province:

  - Organize by general trends: Industry
    Contaminants
    How effective are standards?
    Regional differences

- Take a systems approach to the state of environment.

- Use site-specific data from the contaminant monitoring programs, environmental impact assessments (EIAs), pre-disturbance assessments and land capability classification assessments to report on state of environment and state of land use.

1.4 Regulatory requirements

- Do monitoring required by the Environmental Protection and Enhancement Act (EPEA) – but, figure out what "question" the data answers.

- Identify high impact sites in the province and organize by ecological region and sensitivity - align monitoring intensity with level of impact and sensitivity.

1.5 Land use

- Need to understand land use in the province and be involved in the land use strategy – work with Sustainable Resource Development (SRD) on this. Also critical for support of strategy, Southern Alberta Sustainability Strategy (SASS), Watershed Planning and Advisory Councils (WPAC), State of the Environment reporting.

- Focus on the social and historical context of land use and management – gather knowledge toward cause and effect – model what we expect to happen, monitor against that.

- Creating an information base on land cover, footprints of different uses.

- Establish how land use affects trends in impacts on environmental systems – historic and current.

1.6 Data collection, management and evaluation

- Using standard operating procedures to create common data standards - Code of practice of land users, insurance schemes?

- Planning for watersheds:

  - Know rate of change, source of impact, can predict the point at which tolerance is overwhelmed.

- "Collection" of past data and collate and analyzed to assess trends.

- Baseline data from all land types including cultivated fields.

- Look at the opportunity for planning level data collection.

- Track disturbed landscapes to be able to track reclamation success.

- Standardize reporting requirements.

- AENV to move to auditing role and coordinator of data. Responsibility for data should rest on industry (and consultants to populate database), AENV to manage the process, less review.

- Create amalgamated data sets or access to multiple data sets, use the data we have.

1.7 Working with Municipalities

- Work with municipalities; bring private land into the consultation.

- Work with municipalities, for protection of land in planning process.

1.8 Cumulative Effects

- regional cumulative effects – modeling of future imprints and change over time;
- focus on cumulative effects – compiling data, analyzing it;
- optimize the data we have now into a Cumulative Effects framework; and
- develop a way to look at all the effects from anthropogenic activity on land at the same time - cumulative effects.

1.9 Performance Measures

- Monitoring to ensure that leg/policy/guidelines are delivering what is required by them.

- Process includes determining benchmark values, monitoring sites that represent ecosystem and industry use, determine if we are achieving equivalent capability, if not, what is the issue, policy change, tools needed to achieve it?

- Plan to taper programs – if behaviour response is occurring, the intensity of the monitoring program should ease.

- Define what we consider success.

- Develop performance measures for remediation.

1.10 Focus on the science needs of monitoring related to land.

- Work on contaminants:

  - expand ambient monitoring of "emissions" to provide information on state of the land;
  - follow-up monitoring of all wastes put on land – do they match the guidelines, etc.;
  - look at soil physical properties, infiltration rates, aggregation – e.g., drilling waste;
  - land use monitoring – how much land used for different uses; and
  - reclamation monitoring – are we achieving "equivalent capability" – in what time frame, what are the preconditions for success?

- Standards of application for any contaminant situation – apply across uses.

- Look at land quality – contaminants (point and non-point source, direct applications, spills, background levels), linkage to other matrices (surface and ground water, air).

- Chemical and biological components of the land and soil.

2.0 PARTNERSHIP OPPORTUNITIES

- Other ministries – range health in SRD, Alberta Agriculture's 23 reference plots for soil and vegetation quality, Energy and Utilities Board (EUB) – licensing, place based info, pool mechanisms, airshed groups – look at how airshed and watershed combine to ecosheds, shared database with SRD.

- Other government levels – Prairie Farm Rehabilitation Agency.
- Non-government organizations.
- Environmental farm plan program, Alberta Environmental Sustainable Agriculture (AESA), 4H (stewardship program).
- Alberta Research Council.
- Industry associations.
- WPACs.
- Alberta Lake Management society.
- Canadian Association of Petroleum Producers.
- Environmental Law Centre.
- Alberta Biodiversity Monitoring Program.
- City of Calgary.
- Farm associations.
- Industry groups.
- Partner with industry, etc. in the MOSS monitoring requirements.

Use existing partnerships in place, enhance them, use the model in place, don't need to create a new one.

Work with industry on a data capture system, reporting system – identify relevant information, access and system.

Within WPACS - municipalities.

Land use planning with Municipal Districts and counties and major cities.

3.0 PERFORMANCE MEASURES

3.1 Need to define the indicator and outcome desired

- percentage of stakeholders involved in monitoring;
- percentage of information available in GIS;
- how well the organization is delivering programs;
- linear disturbance per ha;
- how much land base in protective status, open status, urban and industrial;

- land developed versus land reclaimed or undeveloped;
- are industrial spills decreasing;
- number of contaminated sites in the province;
- number of contaminated sites versus industry leases percentage;
- how long does it take for effective reclamation;
- Outcomes related to conditional closure? How to manage risk assessment approach; and
- how much land adjacent to expanding urban areas is Class I or II land.

Monitoring programs that will measure five priority land uses and ten priority land issues within 5 years.

- Each program has defined and accepted thresholds, criteria and guidelines for benchmark use.

- Each monitoring program has components related to ecological, social and economic aspects – triple bottom line reporting.

Province wide indicator of achievement for contaminated sites.

4.0 ISSUES WITH LAND MONITORING PROGRAMS

- Lack of connection to the definition of environmental outcomes as defined elsewhere.

- Philosophy of the process as a whole, monitoring should support process, determine dependencies, identify touchpoints and support integrated management.

- Resource allocation.

- Overall coordination of land programs – who's in charge, to what end? – land is championless.

- Can't afford to monitor at an operational level everywhere so pick indicators.

- Need for GIS system for land information.

- Silos everywhere.

- Proprietary data/sharing agreements/where is the data/what form?

- Need to define goals and outcomes, what is the vision for land management.

- Get people working together.

- Information capture system.

- In partnerships, monitoring has to produce something of value to both parties.

- Resources, particularly people.

- Data costs money, either to collect or to buy from other people.
- Political will to identify the big land issues and set the land framework.
- No defined outcomes.
- Through policy, build an easier way to report things.
- Time and expertise of people.
- Access to data – especially how to capture and use what we already have and streamline future collection.
- Too many programs or activities currently looking at the same or related issues, stretches the abilities of participants. These same initiatives are not integrated to share learnings.
- Need to be able to provide information that supports the high level or broad views, but information is collected at a specific place – e.g., how can EIA process and information support constraints mapping and inform the negotiations around constraints?

5.0 OUTCOMES FOR LAND MONITORING

- Understand the state of the land.
- Focus on priority areas/issues.
- Land cover type over time by ecoregion.
- Footprints.
- Fragmentation of percentage over time.
- In regulatory requirements, move to a regional basis:
  - e.g., exceedances over time in a geographic area; and
  - outcomes that will drive behavioural change.
- Evaluate stresses to land, make judgements, provoke action or behaviour change.
- Create a vision for what we want our land to be in Alberta.
- For new programs, outcomes are critical to come before program developed – why are we monitoring?
- Work to fill in the blanks on reclamation process – surface hydrology criteria? Time to reach equivalent land capability.
- Outcomes should evaluate stewardship by AENV – need to develop indicators.

- Outcomes should be linked to quality of life.
- High level – maintain ecological function.
- Mid level – stewardship, best practices, incentive.
- Low level – knowledge systems and output, awareness and understanding.
- Information and evaluation is available to the public.
- Public is assured of stewardship and has confidence in information and conclusions.
- Information and knowledge on which to base performance measures and progress in achieving broad outcomes, such as a healthy land base.
- Ensure resource extraction operations return land to a productive land capability.
- Reduce releases.
- Land management measures.
- Reduction in contaminated sites.
- Less land consumed by urban sprawl.

6.0 SUSTAINABLE DEVELOPMENT VISION

- land is a finite resource, soil resource needs to be conserved;
- what are the indicators of sustainable development; and
- land monitoring supports the assurance role.

7.0 ALBERTA ENVIRONMENT ROLES

- coordinator of environmental management – needs policy; and
- coordinator of monitoring toward multiple outcomes – help partners realize as many outcomes as possible.

APPENDIX E

LITERATURE REVIEW

APPENDIX E

LAND MONITORING PROGRAM LITERATURE REVIEW

1.0 STRATEGIC ENVIRONMENTAL ASSESSMENT

Several sources were reviewed regarding the Strategic Environmental Assessment (SEA) process used in Europe and the United Kingdom.

Benefits of Strategic Environmental Assessment, Briefing paper for The Regional Environment Center for Central and Eastern Europe; UNDP, REC

1. What is it?

- A systematic process for evaluating the environmental consequences of proposed policy, plan or program initiatives in order to ensure they are fully included and appropriately addressed at the earliest stage possible in decision-making, on par with economic and social considerations.
- SEA helps decision-makers to achieve a number of important environmental objectives and sustainable development aims.
- To allow consideration of ecological dimensions of policy at the same time as economic and other dimensions.
- SEA promotes more sustainable development at the project level.

2. Principles of SEA:

- SEA should cover all proposed policies, plans and programs likely to have significant environmental effects.
- SEA should be undertaken by proponents of a policy, plan or program.
- SEA should be integrated into the process as early as possible and should continue to be applied at key procedural stages.
- SEA should evaluate the environmental effects of a reasonable range of alternatives to the proposed initiative.
- SEA should focus on the right issues at the right stages of the process.
- SESA should facilitate early involvement of key stakeholders.
- SEA should use appropriate and cost-effective methods and techniques of analysis.

3. Benefits of SEA:

- Leads to better environmental protection and management and promotes sustainable development.

- Strengthens policy, plan and program making processes.
- Saves time and money by avoiding costly mistakes.
- Improves good governance, building public trust and confidence in decision-makers/making.

4. Cost of SEA:

- An EC study found that SEA introduction usually raised planning cost by 5% to 10%, but also found examples of good SEAs that increased them by less that 5%.
- Most of the costs associated with SEA application occur during the initial development of methodologies when establishing the appropriate form of SEA.

5. Key Stages of SEA:

Strategic Environmental Assessment Information Service, UK, found at http://www.sea-info.net/

For simplicity, SEA can be broken down into different activities conducted alongside the development of the plan or program and consideration of alternative options. Government guidance in England outlines five stages for SEA which are detailed below.

Stage A: Context & Baseline

The plan making authority needs to consider the availability of background information and propose objectives and indicators for the SEA. This material is required at the outset when issues and options are being developed.

Stage B: Scope & Alternatives

The plan making authority decides the likely scope of the environmental report and what level of detail to be examined. The statutory environmental bodies shall be consulted in this process. At this stage, reasonable alternatives to the plan need to be identified.

Stage C: Assessment & Mitigation

The authorities need to assess the likely effects on the environment of the evolving plan and its alternatives. Where there are significant adverse effects as a result of the plan, information needs to be provided on how these will be reduced, prevented or offset.

Stage D: Consultation & Report

The environmental report is a key output to SEA and should be available for consultation at the same time as the draft plan. After consultation responses have been received, a statement must be made regarding how the Environmental Report and consultation responses have been taken into account in the evolving plan.

Stage E: Monitoring

Monitoring of the significant environmental effects of implementing the plan. This allows any unforeseen adverse effects of the plan to be recognized and dealt with. Monitoring also enables future predictions to be made more accurately and provides baseline information for future plans.

The SEA process, which began as more of an assessment mechanism, has evolved into more of a range of governance processes and tools.

6. A number of countries have implemented SEA strategies, examples come from:

UK – Black Country Study

- Shows how to integrate health issues into an SEA.

North West Regional Assembly

- Concise SEA focusing on key baseline, plans and programmes.

South Africa

- A number of case studies are looked at in Strategic Environmental Assessment in South Africa, Pretoria: Department of Environmental Affairs and Tourism. CSIR (2000).

Hong Kong 2030 Study

- displays a continuous transparent, interactive public engagement process;
- environmental sustainability driven;
- has linkages with sustainability assessment; and
- adopts a stage-wise process in tandem with the planning process.

Vienna, Austria

- Highly participatory process with good monitoring provisions which have proved to work in practice.

2.0 MONITORING PROGRAM DESIGN

Several papers were reviewed that dealt with designing monitoring programs for land in place based initiatives.

Dumanski, J. and C. Pierim, 2000. "Land quality indicators: research plan. Agriculture, Ecosystems and Environment". Volume 81, Issue 2, October 2000, Pages 93-102. Abstract reviewed.

Land quality indicators (LQIs) are being developed although not well developed throughout the world. Land refers to soil combined with terrain, water and biotic resources. Land quality describes conditions in relation to land use requirements. LQI provides for environmental

monitoring and sector performance monitoring. The authors identify core LQIs of immediate importance:

- nutrient balance;
- yield gap;
- land use intensity;
- land use diversity; and
- land cover.

The authors also identify long term research needed for LQIs of:

- soil quality;
- land degradation; and
- agro-biodiversity.

Other groups are developing LQIs on water quality, forestland quality, rangeland quality and land contamination and pollution.

Gordon D.R., L. J. Hardesty, 1997. "Measurement Scales and Ecosystem Management IN: S.T.A. Pickett, R.S. Ostfeld, M. Shachak and G.I. Likens, eds., The Ecological Basis of Conservation: Heterogeneity". Chapman and Hall.

Ecosystem management differs from traditional land management at the landscape level in its emphasis on dynamic function and process – the concepts of non-equilibrium and heterogeneity. Ecosystem management requires definition of the temporal and spatial scales of impact from environmental pressures to the natural system on a regional basis. It requires developing a framework of components that represent the dynamic nature of the landscape components and the functional hierarchy of those components. Management is then directed at maintaining ecological function and process based on the response of the components to management. Larger scale variables should have slower responses than those measured on a small scale. Monitoring the rapidly responding variables on the small scale provides early indication of change in the system, while the slow responding components indicate the strongest response to management initiatives. Monitoring should encompass both rapid and slow responding indicators, as they mirror the bracket of effect of management policy and practices. Spatial analysis within the sampling design is important to allow comparative evaluation of management.

There is a definite need for researchers and managers to work together to implement and evaluate management methods.

MacDonald, Lee H., and Alan Smart, 1993. "Beyond the Guidelines: Practical Lessons for Monitoring. Environmental Monitoring and Assessment 26: 2003-218". Kluwer Academic Publishers, Netherlands.

Integrated monitoring of the effect of forest management activities on water quality in the Pacific Northwest United States was the subject of guidelines developed by the U.S. Environmental Protection Agency in 1991. A follow up to these guidelines was published (MacDonald and Smart, 1993) providing further lessons of watershed monitoring and planning for monitoring described in the following paragraph. They included the concept that monitoring is a continuum

of effort from observational qualitative data collection to rigorous quantitative data collection systems and that both systems have value depending on the indicator and level of conclusions needed. Monitoring programs must identify those parameters sensitive to the land management issue of question, which are capable of indicating impacts from management. Then, setting objectives for the monitoring can focus on the limiting factors for the sensitive parameter and the management practices that affect it. That is, identifying parameters directly and solely (if possible) linked to the land management issue of concern. The authors also indicated that the role of dilution in monitoring within a stream must be accounted for; the farther downstream from a land activity, the more dilution would be apparent. Also, the larger the watershed, the greater the dilution when measured through in-stream parameters. Peer review is required of monitoring program design, as is design of the data management needs prior to beginning to capture data. Finally, the recognition of the uncertainty and risks within the program, that monitoring data cannot be fool proof and some level of uncertainty will remain. Developing a monitoring program that tells a complete "story" from a single parameter is unlikely and there is a trade off between uncertainty and cost of collecting large volumes of data. The authors also noted the need to monitoring management activities on the land, so that water quality changes could be attributed.

Ringold, P.L. et al., 1999. "Establishing a Regional Monitoring Strategy: The Pacific Northwest Forest Plan." Environmental Management, Volume 23, Number 2.

Reflects upon lessons learned and issues raised during the development of an ecosystem monitoring strategy, intended to support the Northwest Forest Plan. Discusses adaptive ecosystem management which requires monitoring as a feedback mechanism, requires action even though knowledge may not be complete. Adaptive monitoring design is a term given to the iterative process of incorporating results of monitoring and interacting with users into monitoring program design.

Schmoldt, Daniel L., David L. Peterson, and David G. Silsbee, 1994. "Developing Inventory and Monitoring Programs Based on Multiple Objectives". Environmental Management Vol. 18, No. 5, pp. 707-727. Springer-Verlag New York Inc.

The authors postulate an analytical framework for comparing multiple objectives in resource inventory and monitoring programs. This is a formal system, referred to as the analytical hierarchy process (AHP), for incorporating the objectives of multiple decision makers and creating a hierarchy of objectives through pair wise comparison. The hierarchy process can be used at multiple levels within a place based initiative to prioritize decision making. The prioritization process is useful in areas like national parks, where economic measures may be less important than legal, social, political and biological concerns and a trade-off dollar amount is not the basis of comparison.

Silsbee, David G., and David L. Peterson, 1991. "Designing and Implementing Comprehensive Long-Term Inventory and Monitoring Programs for National Park System Lands". Natural Resources Report NPS/NRUW/NPR-91/04, United States Department of the Interior, Denver, Colorado.

The National Park Service (NPS) in the United States required a broad monitoring and inventory system that would monitor multiple ecological functions in large and diverse geographical areas. Combined with limited budget, the NPS had to focus program design carefully, identifying program areas that provide the most useful information for the money and time invested.

The authors agree with cited literature that setting objectives is the first hurdle of inventory and monitoring programs, followed by choice of the attributes of the ecosystem that will be monitored, then developing monitoring programs. Common objectives include influencing management decisions, both in terms of outside interests that affect park management and management of internal park resources. A third objective might be determining how a natural system works and a fourth is identifying baseline information.

Selecting attributes to monitor is a process of reducing the large number of monitoring opportunities, from extremely high level to individual organisms, by evaluation of cost to produce data and relevance of the data to the objectives. The complexity of representing an ecosystem may require multiple levels of monitoring programs.

The authors identify monitoring program design as a key element, requiring methodological rigor.

The authors indicate that long term monitoring efforts require an administrative structure in which to coordinate activities and identify responsibilities. The link of monitoring programs to information packages is a key to garnering long term support, as well as reliability and accuracy of monitoring data.

Finally, the authors identify start-up time as a key to developing a broad based monitoring and inventory program for a national park. This includes determining objectives and priorities, setting monitoring protocols, developing reporting procedures and developing a leadership framework.

Zaldis, George C., Maria A. Tsiafouli, Vasilios Takavakoglou, George Bilas and Nikolaos Misopolinos, 2004. "Selecting agri-environmental indicators to facilitate monitoring and assessment of EU agri-environmental measures effectiveness". Journal of Environmental Management, Volume 70, Issue 4, April 2004, Pages 315-321. Abstract reviewed.

Selecting appropriate indicators is a difficult process, to be able to adequately represent complex ecosystem processes and interactions. The EU Common Agriculture Policy requirements has for more environmentally friendly farming practices. Member states are required to link agricultural policies to environmental protection through rural development plans. Environmental standards apply to farming. The authors propose a methodology to assess environmental state and impacts form land use and management in agri-environmental settings. Utilize modified driving forces-pressures-impacts-response framework, allowing evaluation of performance against legislation.

APPENDIX F

PLANNING FRAMEWORK FOR LAND PRESSURE, CONDITION, OUTCOME, INDICATOR AND MONITORING MANAGEMENT

APPENDIX F

LAND PRESSURE, MANAGEMENT AND MONITORING PLANNING MATRIX

Potential Outcomes	Indicators in place	Potential Indicators	Condition	Threshold	AENV Land Monitoring Programs	Other Monitoring Program/Initiatives	Knowledge Products	Potential Partnerships
Land Pressure: Industrial use may result in contamination of the soil and water through chemical release								
Prevent Adverse environmental effects. AENV Coordinates Monitoring. Releases of contaminants to the environment are controlled and remediated; impact is reduced through effective behavioural change. Timely remediation of releases is occurring.	• number of petroleum storage tank (PST) sites remediated; • number of PST sites in risk management; • number of PST new sites; • number of pending PST sites; • number of suspended PST sites.	• number of days between release and remediation completion; • number of releases per company per watershed; • number of releases impacting water bodies or riparian zones; • number of releases on coarse-grained soil with potential for impact to groundwater; • number of contaminated sites in the province as percentage of industrial leases.	Unknown	Point source data evaluated against human health protection limits.	Soil Monitoring Directive Contaminated Sites Air Monitoring Directive PST program Long Term Acid Deposition Program Ambient Metals Program	Federal emission inventory program/ Groundwater monitoring at industrial facilities. Air monitoring at industrial facilities. Health monitoring programs (Wood Buffalo Environmental Association). Terrestrial Environmental Effects Monitoring (TEEM). Cumulative Environmental Management Association (CEMA) – Soil and Vegetation Working Group.	Guidelines, criteria, codes of practice, standards of methodology. SOE indicators regarding PST site stewardship. Acidification of sensitive soils is an SOE indicator of environmental condition. Develop environmental plan program for non-approval sites.	Non-approval industry sites through environmental plans. Consultants through development of electronic database or distributed databases, leading to evaluation of scope of impact. Development of professional sign off program and auditing. Municipalities through land use planning tools. Develop industry codes of practice and standardizing criteria and guidelines across industries.
Land Pressure: Industrial use may result in contamination of the soil and water through chemical release								
Land monitoring programs assure that AENV regulatory responsibilities are met with regard to reclamation.	• number of applications received; • number of applications approved; • percentage of audits meeting inspection.	• Percentage of licensee liability rating (LLR) reviews rejected.	Unknown	Unknown	Reclamation Certification Program.	Cumulative Environmental Management Association (CEMA) – Soil and Vegetation Working Group.	SOE stewardship indicator on oil and gas well reclamation. SOE stewardship indicator of Oil Sands Development and reclamation.	• EUB • CEMA • NRCB • Sand and Gravel developers • Mining industry
Land Pressure: Industrial uses may result in a loss of quality and quantity of land resources during and after use.								
Reclaimed lands meet equivalent land capability.	• percentage of bare surface soil • stoniness • percentage admixing • topography • depth of surface soil • evenness of surface soil over lease • visible erosion.	• percentage of sites where benchmarks of equivalent land capability are met per watershed.	Unknown	Unknown	No post-reclamation programs in place.	Cumulative Environmental Management Association (CEMA) – Soil and Vegetation Working Group. Syncrude Canada Inc. reclaimed landscape program.	Reclamation guidelines.	• SRD • Forest companies • Companies with non-regulated pipelines • APESC • Municipalities • NEB • CEMA • Industry associations – oil and gas, mining, other • Academic institution • Consultants • AAFRD • NRCB • PFRA

APPENDIX F

LAND PRESSURE, MANAGEMENT AND MONITORING PLANNING MATRIX

Potential Outcomes	Indicators in place	Potential Indicators	Condition	Threshold	AENV Land Monitoring Programs	Other Monitoring Program/Initiatives	Knowledge Products	Potential Partnerships
Land Pressure: Resource development requires planning to conserve and protect land resources								
Ensure that information is available to guide reclamation activities.			Unknown	Unknown	Environmental impact assessments. Conservation and Reclamation plans for regulated pipelines. Prairie mine hydrology and reclamation program. Drilling waste disposal program. Mine reclamation programs.	Federal environmental impact assessments on some projects.	Cumulative effects assessments (uncoordinated)	• SRD • Forest companies • Companies with regulated and non-regulated pipelines • APESC • Municipalities • NEB • CEMA • Industry associations – oil and gas, mining, other • Academic institution • Consultants • AAFRD • NRCB • PFRA
Land Pressure: Land use management decisions may result in a loss of land quality or quantity								
Range and land management achieves an acceptable of greater standard of stewardship on public rangeland and riparian habitat.	Established and reported in the range health toolkits.	Unknown	Baseline established	Identified and utilized to create compliance assessment	Unknown	SRD rangeland indicator program.	Carrying capacity and plant community guides. Reports. Research papers. GIS base maps. Range health evaluation tools. Extension courses. Rangeland integration plans developed from the database. Developed policy and coordinated programs based on the tools and data collected.	Range or grazing associations.
Land Pressure: Land use intensity may impact land and water quality and quantity								
River water quality and quantity is assured.	Water quality index (nutrients, bacteria, metals and pesticides)	• Pesticide sales by type by watershed. • Pesticide sales on urban vs. rural basis. • Metals in riparian zone soils vs. metals in upland soils.	See AENV business plan	Not established	Pesticide sales inventory.	Water quality monitoring.	State of the basin reports. Pesticide use in agricultural, industrial and domestic sectors is a SOE indicator of environmental pressure though not reported on watershed basis or linked to watershed index.	• WPACs • Water monitoring branch.

APPENDIX F

LAND PRESSURE, MANAGEMENT AND MONITORING PLANNING MATRIX

Potential Outcomes	Indicators in place	Potential Indicators	Condition	Threshold	AENV Land Monitoring Programs	Other Monitoring Program/Initiatives	Knowledge Products	Potential Partnerships
Land Pressure: Land use may erode the quality or quantity of landforms								
Conservation of landforms is assured in land use planning	Unknown	Other organizations may have indicators Develop landscape indicators with ABMP	Unknown	Unknown	Some new EIA work looks at loss of landforms	Ducks Unlimited reclaimed wetland program Cow and Fish riparian habitat programs		• Nature Conservancy of Canada • Academic institutions • Ducks Unlimited • Cows and Fish • Alberta Biodiversity Monitoring Program • Watershed stewardship groups • Alberta Conservation Association
Land Pressure: Knowledge of the effect of various land uses on land quality is limited								
Unknown	Unknown	Land cover by type of industry Land fragmentation	SASS project modeled condition and future impact from various footprints	Unknown	None in place – may evolved from SASS or the Land Use Framework	Unknown	Baseline footprint information for southern Alberta to be used as a consultation tool. Not published	• CAPP • AAFRD • NRCB • City of Calgary • Land Use Framework